Series 1958, No. 31 Issued June, 1965

SOIL SURVEY

Lovelock Area Nevada

≡ OUR SOIL ★ OUR STRENGTH ≡

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF NEVADA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of the Lovelock Area will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, and other structures; aid ranchers in managing grazing lands; and add to our knowledge of soil science.

Locating Soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the survey area numbered to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs.

Finding Information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

Farmers, ranchers, and those who work with them can learn about the soils in the section "Descriptions of Soils" and then turn to the section "Use and Management of Soils." In this way, they first identify the soils on their farm and they learn how these soils can be managed and what yields can be expected. In the subsection "Range Management," the soils used mainly for grazing have been placed in range sites. Farmers and ranchers interested in improving habitats for wildlife will find this information in the subsection "Managing Soils For Wildlife." The "Guide to Mapping Units" at the back of the report will simplify use of the map and report. This guide lists each soil and land type mapped in the county, and the page where each is described. It also lists, for each soil and land type, the capability unit and range site, and the pages where each of these is described.

Engineers will want to refer to the section "Engineering Applications." Tables in that section show characteristics of the soils that affect engineering.

Scientists and other who are interested will find information about how the soils were formed and how they were classified in the section "Formation and Classification of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in the Lovelock Area will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Facts About the Area."

* * * *

Fieldwork for this survey was completed in 1958. Unless otherwise indicated, all statements in this report refer to conditions in the survey area at the time the survey was in progress. The soil survey of the Lovelock Area was made as part of the technical assistance furnished by the Soil Conservation Service to the Big Meadow Soil Conservation District.

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Issued June 1965

SOIL SURVEY OF THE LOVELOCK AREA, NEVADA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF NEVADA AGRICULTURAL EXPERIMENT STATION

THE LOVELOCK AREA is in the south-central part of Pershing County and the northern part of Churchill County in western Nevada (fig. 1). It has an area of about 118 square miles, or 75,384 acres. Lovelock, the county seat and the principal town in the Area, is 85 miles northeast of Reno and 437 miles west-southwest of Salt Lake City, Utah.

The Lovelock Area is essentially rectangular in outline. It consists of the smooth, level and nearly level flood plain and delta of the Humboldt River, as well as the adjacent, low-lying, nearly level to sloping terraces, alluvial fans, and foothills. In places rolling sand dunes dot the flood plain and the terraces. The elevation ranges from about 3,890 to 4,670 feet above sea level.

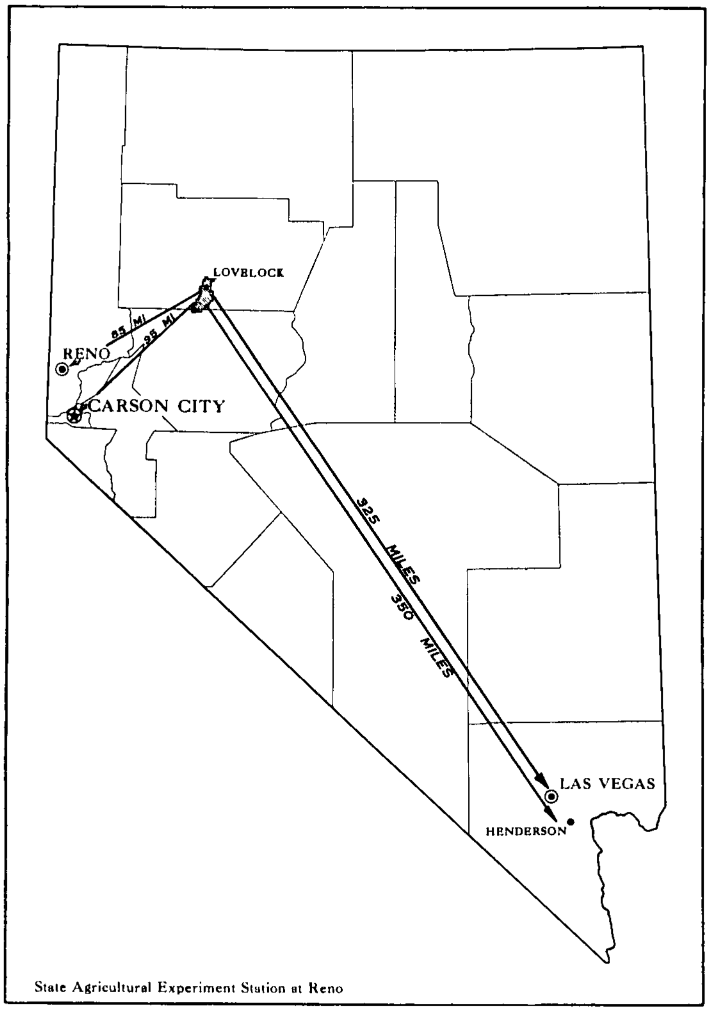

Figure 1.—**Location of the Lovelock Area in Nevada.**

The climate is hot and dry in summer and is cold in winter. Occasionally a very cold spell occurs in winter. The average annual precipitation is about 6 inches.

Agriculture is the chief occupation in the Area, and alfalfa is the principal crop. All crops grown in the Area require irrigation. When the water supply is normal, about 31,000 acres are irrigated.

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soils are in the Lovelock Area, where they are located, and how they can be used.

They went into the Area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the Area, they observed steepness, length, and shape of slopes; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in areas nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Lovelock and Humboldt, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and

in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Humboldt silt loam and Humboldt silty clay are two soil types in the Humboldt series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of wetness, content of salts and alkali, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Humboldt silt loam, slightly saline-alkali, is one of several phases of Humboldt silt loam, a soil type that ranges from nonsaline and nonalkali to strongly saline-alkali.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, there are areas to be shown that are so rocky, so shallow, or so frequently worked by water that they cannot be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Sandy alluvial land, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, engineers, and homeowners. Grouping of soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

After studying the soils in a locality and the way they are arranged, a soil scientist can make a general map that shows the main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic though not strictly uniform.

The soils within any one association are likely to differ in many properties; for example, texture, salinity, stoniness, or drainage. Thus, the general soil map does not show the kind of soil in any particular place, but patterns of soils, in each of which are several different kinds of soils.

Each soil association is named for the major soil series in it, but as already noted, soils of other series may also be present. The major soils of one soil association may also be present in another association, but in a different pattern.

The general soil map is useful to people who want a general idea of the soils, who want to compare different parts of the survey area, or who want to learn the possible location of good-sized areas suitable for a certain kind of farming or other land use.

The Lovelock Area lies in the Great Basin section of the Basin and Range province. Soil associations 1, 2, and 3 are on the flood plain and delta of the Humboldt River and the former bed of Humboldt Lake. They are level or nearly level and contain soils that are imperfectly drained and poorly drained. Soil association 4 occurs on nearly level to sloping terraces, alluvial fans, and foothills. It contains moderately coarse textured and coarse textured soils that are well drained.

1. Sonoma-Placeritos association: Light-colored, very deep, imperfectly drained soils on the nearly level flood plain of the Humboldt River

In this association are light-colored, chiefly medium-textured and moderately fine textured soils that lie on the smooth, nearly level flood plain of the Humboldt River. The Sonoma soils cover the largest acreage, but the Placeritos soils also are important. In addition, there are small areas of the Lahontan, Ocala, and Quincy soils and Sandy alluvial land. The association is the most extensive in the Lovelock Area and makes up about 45 percent of the total Area. Approximately two-thirds of the acreage is in range; the rest is used for irrigated crops and pasture. Sonoma and Placeritos soils all are very deep, imperfectly drained, and strongly calcareous. The Sonoma soils are medium or moderately fine in texture and are somewhat stratified. They have a moderately high content of organic matter and are moderately slow in permeability. Placeritos soils are medium textured, contain a moderate amount of organic matter, and are moderately permeable.

The native vegetation on this association provides little grazing for livestock. It consists of greasewood and saltbush growing in relatively dense stands that have an understory of saltgrass and creeping wildrye in some

places. The saltgrass dominates in the plant cover where the water table is high.

Where water is available, the soils have been leveled, irrigated, and planted to crops or to grass-legume pasture. The principal crops are alfalfa, corn for silage, and small grain, which are commonly grown in rotations. Yields are generally high in areas free of excess salts and alkali, but they are only moderate or low in saline-alkali areas. In the past 20 years, some of the soils have been improved by drainage and deep leaching to remove harmful salts.

If more water becomes available, some of the soils in this association can be reclaimed and irrigated. Before reclamation is started, however, several problems need to be considered. The concentration of salts and alkali in these soils is strong, and the response to treatment will likely be slow. Also, the soils cannot be reclaimed unless adequate drainage is provided. High crop yields can eventually be expected on reclaimed areas.

2. Humboldt-Ryepatch association: Dark-colored, very deep, imperfectly drained soils on the nearly level flood plain and upper delta of the Humboldt River

This soil association is made up of dark-colored, fine textured and moderately fine textured soils that occupy the smooth, nearly level flood plain and upper delta plain of the Humboldt River. The association covers about 32 percent of the Lovelock Area and is mainly in the central part. The Humboldt soils account for most of the association, but the Ryepatch soils also are extensive. In addition, there are small areas of Toy soils and isolated areas of Sonoma soils.

The Humboldt and the Ryepatch soils are very deep, imperfectly drained, and strongly calcareous, and they contain a moderately large amount of organic matter. Humboldt soils are fine or moderately fine in texture and are stratified. Their permeability is moderately slow. Ryepatch soils are very fine textured and have slow permeability. Buried horizons that resemble those of Ryepatch soils occur in several Humboldt soils and influence their management.

Most of this association has an adequate supply of irrigation water and is used for crops and pasture. The soils have been leveled, provided with adequate drainage, and, for the most part, improved by reducing the accumulation of harmful salts. The principal crops are alfalfa, small grain, and corn for silage, which are commonly grown in rotations. In areas free of excess salts and alkali, yields are generally high, but in saline-alkali areas, yields are only moderate or low.

A small acreage of this soil association is in range or is used for homesteads, stackyards, and feedlots. The native vegetation consists mainly of greasewood, saltbush, saltgrass, and creeping wildrye. The range is in small holdings and is little used for grazing.

Some of the soils now in range can be reclaimed and prepared for irrigation if more water is made available. Before the improvements are made, however, the cost of the work and the economic returns need to be estimated carefully. The leveling necessary for irrigation is generally costly because a large amount of soil must be moved. Providing adequate drainage and reducing the concentrations of salts and alkali are not serious problems, though both are needed if the soils are to be reclaimed.

3. Lovelock-Kodak association: Very deep, level and nearly level, poorly drained and imperfectly drained soils on the lower delta of the Humboldt River and the old bed of Humboldt Lake

In this soil association are level and nearly level soils that occupy the lower delta plain of the Humboldt River and the higher lying parts of the former bed of Humboldt Lake. The association makes up about 17 percent of the Lovelock Area and is in the southern part. A small acreage is used for irrigated crops, but most of the association is unsuitable for irrigation because the soils are inadequately drained, are strongly saline, and are likely to be flooded for long periods when Humboldt Lake rises and expands in years of abnormally high runoff. In nonirrigated areas the vegetation is a fair cover of saltgrass, creeping wildrye, bassia, suaeda, heliotrope, and tamarisk. Some of these plants are grazed to a limited extent by livestock.

The Lovelock soils account for nearly all of the acreage in this association, and the Kodak soils make up the rest. All of these soils are very deep, are dark colored, have a high content of organic matter, and contain many shells and shell fragments of fresh-water mollusks.

Lovelock soils occur on flats and in depressions in an area that extends eastward from Humboldt Lake. These soils are stratified, medium and fine textured, strongly calcareous, moderately permeable, and poorly drained or imperfectly drained. Some Lovelock soils contain a slight to strong concentration of soluble salts.

The Kodak soils occur in broad, low, nearly level hummocks or dunes along the eastern shore of Humboldt Lake. They consist of windblown material that accumulated on the surface of Lovelock soils. The Kodak soils are medium textured, imperfectly drained, and strongly affected by soluble salts.

Soils in this association are irrigated where the supply of water is adequate and of fair quality. The soils were improved by leveling, deep leaching of salts, and providing artificial drainage. Also, a dike was built to prevent overflow when the Humboldt Lake rises. On these soils small grain is grown in rotation with alfalfa or is grown year after year. Yields are generally good, but late in summer or early in fall an occasional light frost may reduce yields of small grain and of alfalfa grown for seed.

Some of the better soils now used for range can be reclaimed and prepared for irrigation if more water is made available. Bringing these soils under irrigation will require (1) diking to protect the soils from floodwaters of Humboldt Lake; (2) draining the area through a system of ditches that carry excess water to a concentration point, from where the water can be pumped over the flood-control dike and into a natural watercourse or an artificial drain that discharges into Humboldt Lake; (3) land leveling to provide a relatively smooth and uniform grade; and (4) leaching away harmful salts from the root zone. Experience in similar areas indicates that the harmful effects of sodium will not be a problem.

4. Mazuma-Unionville association: Nearly level to sloping, very deep and moderately deep, well-drained soils on terraces, alluvial fans, and foothills

In this soil association are nearly level to sloping, light-colored, moderately coarse textured and coarse textured soils that occur on high terraces, alluvial fans, and rolling foothills. The association, which makes up about 6 percent of the Lovelock Area, is in a strip of varying width

along the western boundary and in several small areas along the eastern boundary. The Mazuma soils occupy the largest acreage of the association, and the Unionville soils make up much of the rest. Also included are smaller areas of Bluewing, Toulon, Woolsey, and Placeritos soils. All of the association is in range.

The Mazuma and Unionville soils are well drained and moderately coarse textured. They contain little organic matter and are moderately rapid in permeability. Mazuma soils occur on smooth, nearly level alluvial fans and on terraces and offshore bars that formed in ancient Lake Lahontan. They are strongly calcareous, are shallow to very deep over gravel or dense clay, and, in some places, are strongly saline and alkaline. The Unionville soils occur on low-lying, gently rolling foothills and are shallow or moderately deep over granodiorite.

Much of this association has a thin cover of shadscale, bud sagebrush, halogeton, and annual grasses and forbs, but in many areas the vegetation is a pure stand of greasewood. These plants provide little forage for livestock.

The soils in this association are too high to be irrigated, but they are an excellent source of sand and gravel. Several large pits in the area supply sand and gravel for concrete and roadbuilding and for ballast in railroad beds.

Descriptions of Soils

This section describes, in nontechnical language, the soil series (groups of soils) and single soils (mapping units) of the Lovelock Area. The acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is to describe first the soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How Soils Are Mapped and Classified," not all mapping units are members of a soil series. Sandy alluvial land does not belong to a soil series but, nevertheless, is listed in alphabetical order along with the soil series.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Unless stated otherwise, colors given in the profile descriptions are for dry soils. Listed at the end of each description of a mapping unit is the capability unit in which the mapping unit has been placed. For soils used as range, also listed is the range site. The page on which each capability unit and each range site is described can readily be found by referring to the "Guide to Mapping Units" at the back of the report.

Soil scientists, engineers, students, and others who want detailed descriptions of the soil series should turn to the section "Formation and Classification of Soils." Many terms used in the soil descriptions and other sections of the report are defined in the Glossary.

Bluewing Series

The Bluewing series consists of excessively drained, gravelly, coarse-textured soils that developed in alluvium derived from quartzite, granodiorite, limestone, slate, and basic igneous rocks. These soils are on plane or gently convex, slightly eroded or gullied, nearly level to moderately sloping alluvial fans that extend below older terraces and offshore lake bars. They are in the western and southeastern parts of the Lovelock Area, associated with Toulon, Unionville, Mazuma, and Woolsey soils. The vegetation is dominantly shadscale, upland greasewood, bud sagebrush, and halogeton. The plants are sparse and stunted, and approximately 99 percent of the soil surface is bare.

These gravelly soils are soft when dry and are calcareous. The surface layer is light brownish gray, is slightly vesicular in the upper part, and is massive breaking readily to single grain. The subsoil is similar to the surface layer in color, consistence, and structure.

These soils produce a small amount of forage for livestock. They are generally so gravelly and coarse textured that they cannot be used economically for irrigated crops. Some areas are sources of sand and gravel used for construction.

Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes (BgC).—This soil lies on alluvial fans and occurs in areas that extend immediately southwestward from the junction of U.S. Highway No. 40 and Lower Valley road.

Representative profile:

0 to 56 inches, light brownish-gray gravelly loamy coarse sand; massive (structureless); soft when dry and very friable when moist; very strongly calcareous.

The amount of gravel in this soil ranges from 40 to 70 percent. The pebbles are mostly less than 1½ inches across, and there are a few cobblestones in places (fig. 2). The profile is moderately calcareous to very strongly calcareous.

This excessively drained soil has slow runoff, very rapid permeability, and low available water capacity. It is low

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Map symbol	Soil	Area	Extent	Map symbol	Soil	Area	Extent
		Acres	*Percent*			*Acres*	*Percent*
BgC	Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes	98	0.1	Ha	Humboldt silt loam	2,141	2.8
BlC	Bluewing gravelly fine sandy loam, 2 to 8 percent slopes	122	.2	Hb	Humboldt silt loam, drained	90	.1
BtB	Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes	563	.8	Hc	Humboldt silt loam, slightly saline-alkali	975	1.3
				Hd	Humboldt silt loam, strongly saline-alkali	1,017	1.4

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Map symbol	Soil	Area	Extent	Map symbol	Soil	Area	Extent
		Acres	*Percent*			*Acres*	*Percent*
He	Humboldt silt loam, drained, strongly saline-alkali	413	0. 6	MgC	Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes	796	1. 1
Hf	Humboldt silt loam, moderately coarse substratum	467	. 6	Om	Ocala loam, strongly saline-alkali	320	. 4
Hg	Humboldt silt loam, moderately coarse substratum, slightly saline-alkali	839	1. 1	Pa	Placeritos loam	387	. 5
Hh	Humboldt silt loam, moderately coarse substratum, strongly saline-alkali	311	. 4	Pd	Placeritos loam, drained	712	. 9
Hi	Humboldt silt loam, moderately deep over clay	258	. 3	Pf	Placeritos loam, slightly saline-alkali	1, 155	1. 5
Hk	Humboldt silt loam, moderately deep over clay, drained	356	. 5	Pg	Placeritos loam, strongly saline-alkali	2, 135	2. 8
Hl	Humboldt silt loam, moderately deep over clay, slightly saline-alkali	519	. 7	Ph	Placeritos loam, drained, strongly saline-alkali	2, 157	2. 9
Hm	Humboldt silt loam, moderately deep over clay, strongly saline-alkali	72	. 1	Pk	Placeritos loam, over clay, drained, strongly saline-alkali	63	([1])
Hn	Humboldt silt loam, shallow over clay	310	. 4	Pm	Placeritos loam, over silty clay loam, slightly saline-alkali	244	. 3
Ho	Humboldt silt loam, shallow over clay, drained	150	. 2	Pn	Placeritos loam, over silty clay loam, drained, strongly saline-alkali	1, 304	1. 7
Hp	Humboldt silt loam, shallow over clay, slightly saline-alkali	600	. 8	Po	Placeritos loam, over sand	85	. 1
Hq	Humboldt silt loam, shallow over clay, strongly saline-alkali	33	([1])	Pp	Placeritos loam, over sand, slightly saline-alkali	280	. 4
Hr	Humboldt silty clay	4, 741	6. 3	Pr	Placeritos loam, over sand, strongly saline-alkali	982	1. 3
Hs	Humboldt silty clay, drained	372	. 5	Ps	Placeritos loam, terrace, strongly saline-alkali	1, 158	1. 6
Ht	Humboldt silty clay, slightly saline-alkali	1, 202	1. 6	QfD	Quincy fine sand, 0 to 15 percent slopes	2, 202	2. 9
Hu	Humboldt silty clay, strongly saline-alkali	995	1. 3	QtA	Quincy fine sand, over silty clay loam, 0 to 2 percent slopes	500	. 7
Hv	Humboldt silty clay, moderately deep over clay	877	1. 2	Ra	Ryepatch silty clay	1, 556	2. 1
Hw	Humboldt silty clay, moderately deep over clay, slightly saline-alkali	478	. 6	Rd	Ryepatch silty clay, drained	398	. 5
Hx	Humboldt silty clay, shallow over clay	2, 236	3. 0	Rh	Ryepatch silty clay, slightly saline-alkali	744	1. 0
Hy	Humboldt silty clay, shallow over clay, slightly saline-alkali	463	. 6	Rp	Ryepatch silty clay loam	382	. 5
Hz	Humboldt silty clay, shallow over clay, strongly saline-alkaline	157	. 2	Rs	Ryepatch silty clay loam, drained	16	([1])
Ko	Kodak loamy fine sand, moderately deep	465	. 6	Rt	Ryepatch silty clay loam, slightly saline-alkali	639	. 9
La	Lahontan fine sandy loam, sandy variant, strongly saline-alkali	54	([1])	Ry	Ryepatch silty clay loam, strongly saline-alkali	605	. 8
Lb	Lahontan silt loam, strongly saline-alkali	646	. 9	Sa	Sandy alluvial land	573	. 8
Lc	Lahontan silty clay loam, strongly saline-alkali	937	1. 2	Sm	Sonoma silt loam	599	. 8
Ld	Lovelock silt loam, drained	654	. 9	Sn	Sonoma silt loam, drained	257	. 3
Lf	Lovelock silt loam, slightly saline	693	. 9	So	Sonoma silt loam, slightly saline-alkali	1, 673	2. 2
Lg	Lovelock silt loam, strongly saline	3, 854	5. 1	Sp	Sonoma silt loam, strongly saline-alkali	5, 673	7. 6
Lh	Lovelock silt loam, hummocky, strongly saline	692	. 9	Sr	Sonoma silt loam, drained, strongly saline-alkali	2, 177	2. 9
Lk	Lovelock silt loam, occasionally flooded, strongly saline	3, 084	4. 1	Ss	Sonoma silt loam, over clay, slightly saline-alkali	465	. 6
Lm	Lovelock silt loam, overwashed, strongly saline	167	. 2	St	Sonoma silt loam, over clay, strongly saline-alkali	541	. 7
Ln	Lovelock silt loam, moderately deep over clay, drained	660	. 9	Sv	Sonoma silty clay loam	333	. 4
Lo	Lovelock silt loam, moderately deep over clay, drained, slightly saline	113	. 2	Sw	Sonoma silty clay loam, drained	227	. 3
Lp	Lovelock silt loam, shallow over clay, drained	1, 537	2. 0	Sx	Sonoma silty clay loam, slightly saline-alkali	1, 228	1. 6
Lr	Lovelock silt loam, shallow over clay, strongly saline	423	. 6	Sy	Sonoma silty clay loam, strongly saline-alkali	1, 398	1. 9
Ls	Lovelock silt loam, hummocky, shallow over clay, strongly saline	180	. 2	TgB	Toulon very gravelly loam, 0 to 4 percent slopes	167	. 2
MaA	Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes	488	. 7	To	Toy silty clay, strongly saline-alkali	99	. 1
McA	Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes	193	. 3	Ty	Toy silty clay loam, strongly saline-alkali	335	. 4
				UnC	Unionville very rocky coarse sandy loam, 4 to 8 percent slopes	890	1. 2
				WoC	Woolsey gravelly fine sandy loam, 2 to 8 percent slopes	368	. 5
					Humboldt Lake	1, 298	1. 7
					Humboldt River	293	. 4
					Outcrops	12	([1])
					Playas	2, 001	2. 7
					Sloughs	262	. 4
					Total	75, 384	100. 0

[1] Less than 0.05 percent.

Figure 2.—**Profile of Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes. The soil consists mainly of stratified gravel, sand, and cobbles.**

in fertility and has a very thick root zone. The erosion hazard is slight.

Use and management.—Nearly all of this soil is in range, but the vegetation is too sparse and stunted to provide much forage for livestock. The soil is a good source of sand and gravel used in construction. It is good to excellent as subgrade material, good as subbase material, and fair to good as base material. (Capability unit VIIs-4; nonirrigated; Desert Uplands range site)

Bluewing gravelly fine sandy loam, 2 to 8 percent slopes (BlC).—This soil has a finer textured surface layer than Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes. Included with this soil, in the northwestern corner of the survey area, is a small area that has relief similar to that of Toulon soils. The subsoil and the substratum of the included areas are more than 80 percent gravel that is made up of pebbles about 1 inch across and essentially the same size.

Use and management.—This soil is used and managed in much the same way as Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes. For use in construction, the surface layer is fair to good as subgrade and subbase material and is poor as base material. (Capability unit VIIs-4, nonirrigated; Desert Uplands range site)

Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes (BtB).—This soil occurs along the western edge of the Area, almost due west of the town of Lovelock. It is similar to Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes, but in most places it is underlain by unconformable tufa at a depth of 15 to 26 inches. The surface is covered by waterworn pebbles that form an erosion pavement normally lacking on other Bluewing soils.

In a few places the tufa is lacking, and the unconformable substratum consists of material weakly cemented by lime.

This excessively drained soil is low in natural fertility. It has very slow runoff, very rapid permeability, and very low available water capacity. The root zone is 10 to 20 inches thick. Because of runoff from higher lying soils, there is a slight hazard of erosion.

Use and management.—All of this soil is in range that provides little forage for livestock. The soil is not suitable for irrigation. (Capability unit VIIs-4, nonirrigated; Desert Uplands range site)

Humboldt Series

In the Humboldt series are imperfectly drained, somewhat stratified, moderately fine textured and fine textured soils that developed in sediments deposited along streams and in shallow lakes. The sediments were derived from limestone, basalt, tuff, reworked lacustrine deposits, and other material. These soils are on nearly level flood plains and deltas and occur principally with Ryepatch and Sonoma soils.

In their natural condition, the Humboldt soils were poorly drained, were flooded every year, and had a dense cover of grasses and sedges. The drainage has been improved, but now the soils are affected by salts and alkali. The present vegetation is greasewood, saltbush, saltgrass, and creeping wildrye, all of which vary in density from place to place.

Humboldt soils are generally very deep and calcareous throughout. The surface layer is gray and hard and has subangular blocky structure. The upper subsoil is light gray to gray, very hard, somewhat stratified, and subangular blocky in structure. The lower subsoil is light greenish gray, subangular blocky, mottled, and hard. The substratum is light gray to white, soft to hard, and stratified; it has subangular blocky structure or is massive. In the upper part of the substratum there are few to common iron mottles and organic stains. In some places soluble salts and alkali occur in the surface layer, the subsoil, or the substratum, but the amount depends on the adequacy of drainage and the degree of reclamation.

Most areas of Humboldt soils are irrigated and used for all crops grown locally. A few areas are too high for gravity irrigation, and a small acreage is occupied by the town of Lovelock. The soils are well suited to lawns, flowers, ornamental shrubs, and orchard and shade trees. However, plants that are sensitive to lime-induced chlorosis must be treated with iron chelates or ferric sulfate.

Humboldt silty clay (Hr).—Large areas of this soil occur in the areas extending northward and southward from Lovelock.

Representative profile:

0 to 14 inches, gray silty clay, black when moist; subangular blocky structure; hard when dry and firm when moist; slightly calcareous.

14 to 24 inches, light-gray to gray silty clay loam to silty clay, very dark grayish brown to very dark gray when moist; subangular blocky structure; very hard when dry and firm when moist; slightly calcareous.

24 to 33 inches, light greenish-gray clay, dark greenish gray when moist; mottled; subangular blocky structure; very hard when dry and firm when moist; slightly calcareous.

33 to 61 inches, light-gray to white, stratified silty clay and silt loam; subangular blocky structure to massive; hard to soft when dry, firm to very friable when moist; slightly calcareous.

In cultivated areas that have been leveled, the surface layer ranges from 10 to 24 inches in thickness. Stratification occurs in all horizons but not in an orderly sequence of texture or thickness. The content of lime varies from low

to high throughout the profile. In many places the substratum contains lime concretions that are few or common, fine, and firm or very firm. In some places few to common fragments of the shells of fresh-water mollusks are in the subsoil or substratum. During the peak of the irrigation season, the water table is within 4 to 6 feet of the surface. In places a slight concentration of salts and alkali has accumulated in the substratum through evaporation of ground water or leaching from the surface layer.

This imperfectly drained soil has very slow runoff, moderately slow permeability and high available water capacity. It is high in natural fertility and has a very deep root zone. The erosion hazard is slight.

Use and management.—This soil is irrigated and is used for alfalfa grown in rotation with small grain or pasture or at times with a row crop. When a normal seasonal supply of water is forecast, corn for silage can safely be substituted for small grain in the rotation. Sugar beets have been grown, but with little success because of disease and insufficient water. The soil is also used for small gardens.

This soil is highly productive. Crops generally respond well to additions of nitrogen alone or to nitrogen and phosphate together. However, the response of alfalfa to added phosphate is variable. Applying barnyard manure and returning crop residue to the soil help to maintain good tilth and a high rate of water intake.

As a rule, this soil should be plowed as little as possible and only when the moisture content is below field capacity. If worked when too wet, the soil generally will not scour a plow. Determining the best time for plowing is often difficult, however, because the strata that make up the surface layer are so variable in texture.

The leaves of plants grown on this soil may turn yellow. The yellowing is a symptom of lime-induced chlorosis and indicates that the soil contains so much lime that the plants cannot obtain enough iron for normal growth. Lime-induced chlorosis is most prevalent in flowers, ornamental shrubs, orchard crops, and shade trees. Some crops, such as alfalfa and corn, are affected but not consistently. Chlorosis can be corrected by applying iron chelates or ferric sulfate.

Except for a heavy irrigation once a year to remove excess salts, careful use of irrigation water is necessary on this soil. Excessive irrigation can build up the water table and increase the salt content of the soil. Artificial drainage is needed to keep the water table at a safe level during irrigation, to dispose of soluble salts removed in leaching, and to reduce the amount of salts and alkali in the soil. (Capability unit IIw–5, irrigated)

Humboldt silt loam (Ha).—This soil is similar to Humboldt silty clay but has a silt loam surface layer that is 9 to 16 inches thick. In addition its rate of water intake is more rapid.

Use and management.—This soil is used in much the same way as Humboldt silty clay. It is easier to cultivate than that soil and scours tillage implements more readily. (Capability unit IIw–2, irrigated)

Humboldt silt loam, drained (Hb).—This soil is essentially the same as Humboldt silty clay but has a silt loam surface layer that is 9 to 16 inches thick. Also, the water table is lower, and the subsoil and substratum generally are free of excess salts and alkali. The water table is

Figure 3.—**Profile of Humboldt silt loam, strongly saline-alkali. The dry surface layer is 1 foot thick and is flocculated because the concentration of salts is high. The moist subsoil is 2 feet thick and overlies a glazed substratum.**

6 to 9 feet below the surface during the peak of the irrigation season.

Use and management.—This soil is used and managed in much the same way as Humboldt silty clay. Care is needed in irrigating to avoid raising the water table. (Capability unit IIw–2, irrigated)

Humboldt silt loam, slightly saline-alkali (Hc).—This soil is similar to Humboldt silty clay but has a silt loam surface layer 9 to 16 inches thick and is slightly affected by salts and alkali. In some places the subsoil and substratum are moderately to strongly affected. Where this has occurred, the intake of water has been reduced.

Use and management.—This soil is used for all salt- and alkali-tolerant crops grown in the Area.

Large amounts of irrigation water are required to leach the soluble salts from the surface layer and subsoil. Deep wetting is impossible, however, in areas that contain moderate to strong concentrations of salts and alkali, until the harmful effects of sodium are removed. Applying gypsum or sulfur changes alkali to soluble salts and makes the soil more permeable to water and roots. Artificial drainage is needed to lower the water table and carry away the water used in leaching. (Capability unit IIw–6, irrigated)

Humboldt silt loam, strongly saline-alkali (Hd).—The surface layer of this soil is 9 to 16 inches thick. It is coarser textured than that of Humboldt silty clay and is strongly affected by salts and alkali (fig. 3). The excess salts and alkali have been concentrated in the surface layer

by the action of plants and by the rise and evaporation of ground water containing soluble salts. The vegetation is greasewood and saltbush and an understory of saltgrass, creeping wildrye, and scattered alkali sacaton. These plants cover 10 to 20 percent of the soil surface, depending on the amount of salts and alkali present and the height of the water table.

Use and management.—Some of this soil is in range, but its use is limited. The rest is used for farmsteads, feedlots, and stackyards, or is idle. Irrigation water is not now available.

Reclaiming this soil is feasible if more irrigation water is made available. Management would be about the same as that for capability unit IIw–6. Among the practices needed are land leveling, constructing irrigation ditches, and providing adequate drainage. While improvement is underway, it would probably be best to plant only the crops that are highly salt and alkali tolerant. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Humboldt silt loam, drained, strongly saline-alkali (He).—This soil occurs as high-lying bodies or mounds in irrigated areas. It is essentially the same as Humboldt silty clay but has a silt loam surface layer 12 to 18 inches thick, and it contains strong concentrations of salts and alkali. The water table is at a depth of 8 to 12 feet. The plants are mainly greasewood and saltbush, but there is also a little saltgrass and creeping wildrye. Vegetation covers 10 to 20 percent of the soil surface, depending on the amount of salts and alkali in the soil.

Use and management.—This soil is too high for gravity irrigation. Some of the acreage is used for range and for farmsteads, feedlots, and stackyards. The rest is idle. (Capability unit VIIs–6, nonirrigated; Alkali Flats range site)

Humboldt silty clay, drained (Hs).—Excess water is removed from this soil through artificial drainage. Consequently, the water table is lowered to a depth of 6 to 9 feet during the peak of the irrigation season, and an accumulation of salts in the subsoil and substratum is prevented. Otherwise, this soil is similar to Humboldt silty clay.

Use and management.—This soil is used in about the same way as Humboldt silty clay. By irrigating carefully and maintaining drain ditches periodically, the water table can be kept from rising. (Capability unit IIw–5, irrigated)

Humboldt silty clay, slightly saline-alkali (Ht).—This soil is similar to Humboldt silty clay but is slightly saline-alkali affected. As a result, the rate of water intake is somewhat reduced. In some areas the substratum contains moderate to strong concentrations of salts and alkali that cause it to be nearly impervious to water and roots.

Use and management.—This soil is used for all locally grown irrigated crops that tolerate slight amounts of salts and alkali.

Applying manure and turning under crop residue improve tilth and increase the water intake rate. Deep leaching and applying gypsum or sulfur help reclaim the saline-alkali areas, improve water intake, and increase permeability. In addition, adequate drainage is needed to lower the water table and carry away the excess salts that are leached from the soil. (Capability unit IIIw–56, irrigated)

Humboldt silty clay, strongly saline-alkali (Hu).—This soil is similar to Humboldt silty clay except that it is strongly affected by salts and alkali that accumulate in the surface layer through the rise and evaporation of saline ground water. The vegetation is dominantly greasewood and saltbush, and there is an understory of saltgrass, creeping wildrye, and some alkali sacaton. The density of the plants ranges from 10 to 20 percent, depending on the amount of salts and alkali in the soil and the level of the water table.

Use and management.—This soil is idle or is used for limited livestock grazing, or for farmsteads, stackyards, or feedlots. Water for irrigation is not now available.

If more water is made available, this soil can be reclaimed, cultivated, and managed like the soils in capability unit IIIw–56. Preparing the soil for irrigation requires land leveling, constructing irrigation ditches, and installing drains. Only the most salt- and alkali-tolerant crops should be grown during the reclamation period. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Humboldt silt loam, moderately coarse substratum, slightly saline-alkali (Hg).—This soil is in scattered areas throughout Upper and Lower Valleys. It lies in narrow drainageways and old slough channels that dissect other Humboldt soils and Ryepatch soils. It is similar to Humboldt silty clay but has a silt loam surface layer that is 9 to 16 inches thick. A moderately coarse textured substratum begins at an average depth of 29 inches.

The depth to the substratum ranges from 14 to 36 inches. The substratum varies widely in texture as a result of stratification. It is dominantly sand in Upper Valley and fine sandy loam or loamy fine sand in Lower Valley, but it ranges from silt loam, which occurs in thin strata, to coarse sand. The water table is generally 3 to 5 feet below the surface, though the level differs widely from place to place because of differences in irrigation and drainage. The water table is higher and fluctuates less in areas that are crossed by unlined ditches and canals than in other areas.

The natural drainage of this soil is imperfect. Runoff is very slow. Permeability is moderately slow in the surface layer and the subsoil and generally is moderately rapid in the substratum. The available water capacity and natural fertility are high. The soil has a very deep root zone. Erosion is a slight hazard. A slight concentration of excess salts and alkali generally occurs above the water table. Ordinarily, the concentration is strongest just above the capillary fringe of the water table.

Use and management.—This soil occurs in small areas that are used and managed like the surrounding soils. For this reason, crops grown in these areas are commonly underirrigated because this soil is somewhat lower in available water capacity than the adjacent soils.

This is an important soil in areas that require artificial drainage. The porous substratum acts as an aquifer; it receives water from adjoining soils and transmits it readily. For fields in which the soil occurs, irrigation systems should be designed so that drains intercept the substratum. Irrigation ditches built in areas of this soil should be lined to prevent excessive seepage losses. (Capability unit IIw–6, irrigated)

Humboldt silt loam, moderately coarse substratum (Hf).—This soil lacks excess salts and alkali in the surface

layer, but in other respects it is similar to Humboldt silt loam, moderately coarse substratum, slightly saline-alkali. The water table generally occurs at a depth of 4 to 5 feet, and the water moves through the soil laterally, or nearly so. As a result, the soil is kept free of the harmful effects of soluble salts.

Use and management.—This soil is in small bodies and is used and managed the same way as adjacent soils. (Capability unit IIw–2, irrigated)

Humboldt silt loam, moderately coarse substratum, strongly saline-alkali (Hh).—This soil is essentially the same as Humboldt silt loam, moderately coarse substratum, slightly saline-alkali, but the surface layer is strongly affected by salts and alkali that are concentrated by the capillary rise and the evaporation of saline ground water. In irrigated areas, the water table fluctuates between depths of 3 and 4 feet during the peak of the irrigation season.

Use and management.—If this soil is reclaimed, it can be used and managed in about the same way as Humboldt silt loam, moderately coarse substratum, slightly saline-alkali. The water table can be lowered by artificial drains, which also remove excess water from surrounding soils. Deep leaching and applying of gypsum or sulfur are needed to reduce the concentration of salts and alkali. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Humboldt silty clay, moderately deep over clay (Hv).—This soil occurs throughout the central part of Lower Valley, in the area of transition between Humboldt and Ryepatch soils. It is similar to Humboldt silty clay, except that it overlies slowly permeable clay at a depth of 24 to 36 inches. The clay layer has a clay content of more than 55 percent and is strong in structure.

In some places the soil is stratified in the surface layer and subsoil. The surface layer ranges from 12 to 21 inches in thickness. During the peak of the irrigation season, the water table rises to within 4 to 6 feet of the surface. Small amounts of salts and alkali are deposited just above the water table.

This imperfectly drained soil has very slow runoff. Permeability is moderately slow in the surface layer and upper subsoil and is slow in the clay substratum. The available water capacity and the natural fertility are high. Roots penetrate deeply. The erosion hazard is only slight.

Use and management.—This soil is used for the same crops as Humboldt silty clay.

The slow permeability of the clay substratum should be taken into account when designing an irrigation system for this soil and when irrigating fields in which it occurs. Excessive irrigation causes a temporary perched water table that injures the roots and shortens the life of alfalfa and other deep-rooted crops. Once it builds up, a perched water table is not readily removed by drainage. (Capability unit IIw–35, irrigated)

Humboldt silt loam, moderately deep over clay, drained (Hk).—This soil is similar to Humboldt silty clay, moderately deep over clay, but it has a silt loam surface layer that is 12 to 18 inches thick. In addition, the water intake rate is more rapid, drainage is better, and excess salts and alkali are generally lacking. A few places are saline-alkali affected below a depth of 48 inches. Because the soil is artificially drained, the water table is lowered to a depth of 6 to 9 feet during the peak of the irrigation season.

Use and management.—This soil is used in about the same way as Humboldt silty clay, moderately deep over clay. Care in irrigation is necessary to avoid building up a perched water table that may shorten the life of alfalfa stands. Unless drains are cleaned and maintained periodically, the water table will probably rise again. (Capability unit IIw–3, irrigated)

Humboldt silt loam, moderately deep over clay (Hi).—This soil is similar to Humboldt silty clay, moderately deep over clay, except that it has a silt loam surface layer that is 12 to 18 inches thick and a more rapid rate of water intake. In places the soil contains slight concentrations of salts and alkali at a depth of about 3 feet.

Use and management.—This soil is used and managed in about the same way as is Humboldt silty clay, moderately deep over clay. Care in irrigating is essential to avoid the buildup of a perched water table that can shorten the life of alfalfa stands. (Capability unit IIw–3, irrigated)

Humboldt silt loam, moderately deep over clay, slightly saline-alkali (Hl).—This soil has a silt loam surface layer 12 to 18 inches thick, and it generally contains salts and alkali throughout the profile. In other respects it is similar to Humboldt silty clay, moderately deep over clay. In a few areas, mainly old sloughs or channels, the clay layer contains moderate to strong concentrations of salts and alkali that reduce permeability and hinder penetration of roots. In these areas, crops show evidence of injury during prolonged dry periods.

Use and management.—The soil is used for all crops grown locally that are salt and alkali tolerant.

Soil tilth and the intake of water are likely to be improved by applying manure and turning under crop residue. Salts and alkali can be removed by deep leaching and applications of gypsum or sulfur. Unless care is taken in irrigation, a perched water table may build up over the clay layer. Perched water injures the roots and shortens the life of alfalfa and other deep-rooted crops. Adequate drainage is required to leach out the salts and to lower the level of the ground water. (Capability unit IIIw–36, irrigated)

Humboldt silt loam, moderately deep over clay, strongly saline-alkali (Hm).—This soil is similar to Humboldt silty clay, moderately deep over clay. The surface layer, however, is coarser textured, slightly thinner, and strongly saline-alkali. It is 12 to 18 inches thick. The excess salts and alkali accumulated at and near the soil surface when saline ground water rose and evaporated. The vegetation is a dense stand of greasewood and saltbush and an understory of saltgrass and creeping wildrye. The plants cover 10 to 20 percent of the surface, depending on the amount of salts and alkali in the soil and the level of the water table.

Use and management.—Part of the acreage of this soil is in range that is used for limited grazing. The rest is used for stackyards, farmsteads, and feedlots, or is idle. Water for irrigation is not available.

This soil can be reclaimed, leveled and irrigated if water is made available and if adequate drainage is provided. Management would be about the same as that for the soils in capability unit IIIw–36. Only the crops most tolerant of salts and alkali should be grown during reclamation.

(Capability unit VIIw-6, nonirrigated; Alkali Flats range site)

Humboldt silty clay, moderately deep over clay, slightly saline-alkali (Hw).—This soil is slightly saline-alkali, generally throughout the profile. In some places the clay layer contains moderate to large amounts of salts and alkali that reduce permeability and hinder penetration of roots. Otherwise, this soil is similar to Humboldt silty clay, moderately deep over clay.

Use and management.—This soil is used for all salt- and alkali-tolerant crops grown locally.

Applying manure and turning under crop residue increase the intake of water and improve the tilth of this soil. Deep leaching, applications of gypsum or sulfur, and artificial drainage are needed to reduce the concentration of salts and alkali and to remove excess water. As the alkali content is lowered, water intake and permeability are likely to increase. Irrigation must be done with care, however, because the underlying clay layers will remain slowly permeable after the soil is fully reclaimed. (Capability unit IIIw-356, irrigated)

Humboldt silty clay, shallow over clay (Hx).—This soil occupies the transitional area between Humboldt and Ryepatch soils throughout the central part of Lower Valley. It is similar to Humboldt silty clay, except that it is underlain, at a depth of 14 to 24 inches, by slowly permeable clay that resembles a Ryepatch soil. The clay has strong structure and has a clay content of more than 55 percent.

Strata of silty clay loam and clay occur in the surface layer but are not in an orderly sequence of texture or thickness. In most places the subsoil is a clay layer that is slightly affected by salts and alkali and is mottled in many ways, though the only coarse mottles are lime splotches. The soil is moderately or strongly calcareous. In the clay layer are a few, very hard, lime concretions that are fine or very fine in size.

This soil is imperfectly drained. Runoff is very slow. Permeability is moderately slow in the surface layer and is slow in the clay layer. The soil has a moderate available water capacity, is high in natural fertility, and has a deep root zone. It is affected by a high water table that rises to within 4 to 6 feet of the surface during the peak of the irrigation season. The erosion hazard is slight.

Use and management.—This soil is used and managed in about the same way as Humboldt silty clay. Because the clay layer is slowly permeable, it should be taken into account when designing irrigation systems and when irrigating fields in which this soil occurs. Excessive use of water can easily waterlog this soil, form a perched water table, and injure the roots of crops. Excess water that accumulates in this way is difficult to remove through drainage. (Capability unit IIw-35, irrigated)

Humboldt silt loam, shallow over clay, drained (Ho).—This soil is much like Humboldt silty clay, shallow over clay, but it has a silt loam surface layer 12 to 20 inches thick. In addition, this soil has a more rapid intake of water and is better drained. Most of the excess water is removed through drains that lower the water table to a depth of 6 to 9 feet during the peak of the irrigation season. Generally, the soil is free of excess salts and alkali, but at a depth below 48 inches it may be saline-alkali in a few places.

Use and management.—This soil is used and managed in about the same way as Humboldt silty clay, shallow over clay, but it requires more care in irrigation because water enters the surface layer more rapidly. Drain ditches require cleaning periodically. If they are allowed to choke up with weeds and sediment, the water table is likely to rise again. (Capability unit IIw-3, irrigated)

Humboldt silt loam, shallow over clay (Hn).—This soil is similar to Humboldt silty clay, shallow over clay, but the silt loam surface layer is only 12 to 20 inches thick, and the intake of water is more rapid.

Use and management.—This soil is used and managed in about the same way as Humboldt silty clay, shallow over clay. It needs more care in irrigation, however, because the water enters the soil more rapidly and increases the risk of waterlogging. (Capability unit IIw-3, irrigated)

Humboldt silt loam, shallow over clay, slightly saline-alkali (Hp).—This soil is similar to Humboldt silty clay, shallow over clay, but it has a silt loam surface layer that is 12 to 20 inches thick. Also, it is slightly affected by salts and alkali, generally throughout the profile. In some places the clay layer contains moderate to strong concentrations of salts and alkali that reduce permeability in that part of the soil and restrict the penetration of roots.

Use and management.—This soil is used for locally grown crops that are tolerant of salts and alkali.

Turning under crop residue and applying manure increase the intake of water and improve titlth. Deep leaching and applications of gypsum or sulfur remove salts and alkali, if the soil is adequately drained. Careful irrigation is necessary to prevent the accumulation of perched water just above the clay layer. Perched water can damage deep-rooted crops and shorten their life. (Capability unit IIIw-36, irrigated)

Humboldt silt loam, shallow over clay, strongly saline-alkali (Hq).—This soil is similar to Humboldt silty clay, shallow over clay. The surface layer, however, is silt loam and is only 12 to 20 inches thick. The soil contains large amounts of salts and alkali that concentrate when ground water containing dissolved salts moves upward into the surface layer and evaporates. The vegetation is a dense stand of greasewood and saltbush, and there is an understory of saltgrass, creeping wildrye, alkali sacaton, and bassia. Plants cover 10 to 20 percent of the soil surface, depending on the height of the water table and the amount of salts and alkali.

Use and management.—Some areas of this soil are in range, but their use for grazing is limited. The remaining acreage is used for farmsteads, stackyards, and feedlots, or is idle. Water for irrigation is not now available.

If water becomes available, this soil can be reclaimed and improved for irrigation. Among the measures needed are leveling, constructing irrigation ditches, and furnishing adequate drainage. After improvement, the soil would be managed in about the same way as the soils in capability unit IIIw-36. While reclamation is under way, only the crops most tolerant of salts and alkali should be grown. (Capability unit VIIw-6, nonirrigated; Alkali Flats range site)

Humboldt silty clay, shallow over clay, slightly saline-alkali (Hy).—This soil is slightly affected by salts and alkali, generally to the depth of the water table. In some places the clay layer is moderately affected and, consequently, is very slowly permeable to water and roots.

Otherwise, this soil is similar to Humboldt silty clay, shallow over clay.

Use and management.—This soil is used for locally grown crops that are tolerant of salts and alkali.

Tilth can be improved and the intake of water increased by adding manure and crop residue to the soil. Soluble salts and alkali can be removed by following the application of gypsum or sulfur with leaching. Adequate drainage is needed to remove excess water and thereby lower the water table. Careful irrigation is necessary to avoid a perched water table that may injure deep-rooted crops. (Capability unit IIIw–356, irrigated)

Humboldt silty clay, shallow over clay, strongly saline-alkali (Hz).—This soil is strongly affected by salts and alkali that are accumulated by the capillary rise and the evaporation of ground water that contains dissolved salts. Otherwise, the soil is similar to Humboldt silty clay, shallow over clay. Greasewood and saltbush dominate in the vegetation. The understory consists of saltgrass, creeping wildrye, and alkali sacaton. These plants cover 10 to 20 percent of the surface, depending on the content of salts and alkali and the height of the water table.

Use and management.—Some areas of this soil are in range, but their use for grazing is limited. The remaining acreage is used for farmsteads, stackyards, and feedlots, or is idle. Irrigation water is not now available.

If water becomes available, this soil can be reclaimed, prepared for irrigation, and managed like the soils in capability unit IIIw–356. Among the measures needed for improvement are leveling, constructing irrigation ditches, and providing adequate drainage. Until the soil is fully reclaimed, the only suitable crops are those that are highly tolerant of salts and alkali. (Capability unit VIIw–6; Alkali Flats range site)

Kodak Series

The Kodak series consists of imperfectly drained, moderately coarse textured and medium-textured soils that developed in eolian material blown from nearby Lovelock soils, and blown from beaches, marshes, and lake and stream deposits near the edge of Humboldt Lake. The material was deposited on the surface of Lovelock soils and is moderately deep or deep. Kodak soils are in the southwestern part of Lower Valley adjacent to Humboldt Lake. The vegetation consists of a moderately dense stand of heliotrope and suaeda, and there are scattered greasewood plants and patches of saltgrass. The plants cover 10 to 20 percent of the surface.

These soils are strongly calcareous and contain many fragments of shells from fresh-water mollusks. The surface layer is gray, is soft to slightly hard, and has a platy structure or is massive. The subsoil is similar to the surface layer, is soft to slightly hard, and is massive. The underlying material is gray, slightly hard, and massive.

Kodak loamy fine sand, moderately deep (Ko).—This soil occurs in the southwestern corner of the Area, where the Humboldt River flows into Humboldt Lake. In years of abnormally high runoff, it is occasionally flooded for long periods when the lake rises and expands. It occupies low, broad mounds that were deposited by wind on Lovelock soils. The surface layer is strongly saline and alkali. A water table is generally within 4 to 6 feet of the surface, the depth depending on the level of Humboldt Lake.

Representative profile:

0 to 9 inches, gray loamy fine sand; platy structure to massive; slightly hard to soft when dry and very friable when moist; strongly calcareous.

9 to 31 inches, gray fine sandy loam and very fine sandy loam; massive; soft to slightly hard when dry and very friable when moist; strongly calcareous.

31 to 60 inches +, gray silt loam; massive; slightly hard when dry and friable when moist; strongly calcareous.

The depth of the wind-laid deposits ranges from 20 to 40 inches. In most areas the mounds that make up this soil are 12 to 20 inches high. At the north end of Humboldt Lake, however, they are 2 to 6 feet high and are 4 to 20 feet across at the base. Generally, each mound has a single suaeda or greasewood plant on top and a cover of heliotrope or saltgrass on the sides. Much of the sand is tiny fragments of shells from fresh-water mollusks. The underlying layer is generally stratified and ranges from silt loam to clay. Common in this layer are black organic stains and light-gray mottles and splotches of lime.

This imperfectly drained soil is moderately permeable, has a moderate available water capacity, and is moderately fertile. Roots penetrate very deeply. Runoff is very slow, and the soil is only slightly susceptible to water erosion but is likely to blow severely if the plant cover is disturbed.

Use and management.—This soil is used to a limited extent for range. The vegetation is mostly unpalatable to livestock, though a few plants are desirable. Because the content of salt is high and occasional flooding is likely, this soil is unsuitable for irrigation. It is poorly suitable or not suitable as a source of material used in construction. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Lahontan Series

The Lahontan series consists of moderately deep, imperfectly drained, fine-textured soils that developed in nearly level alluvium washed from many kinds of igneous and sedimentary rocks. These soils are on lacustrine terraces and deltaic flood plains. They are in the southeastern part of Lower Valley and occur with Ocala, Lovelock, Sonoma, and Placeritos soils. The vegetation is dominantly greasewood, and there are a few patches of saltgrass, but in most places the soil surface is nearly bare.

These soils are intermittently calcareous and are slowly or very slowly permeable. The surface layer is light brownish gray, very hard, and angular blocky in structure. The subsoil and the substratum are light brownish gray or light gray, are very hard, and have angular or subangular blocky structure or are massive. In the Lovelock Area, these soils are strongly saline-alkali.

The only agricultural use of these soils is limited livestock grazing. The carrying capacity is very low because only a small amount of forage is produced.

Lahontan silty clay loam, strongly saline-alkali (Lc).—This soil is in the southeastern part of Lower Valley, just south of Big Five Reservoir and east of the Humboldt River.

Representative profile:

0 to 4 inches, light brownish-gray silty clay loam; angular blocky structure; very hard when dry and very firm when moist; slightly calcareous.

4 to 20 inches, light brownish-gray clay; subangular and angular blocky structure; very hard when dry and very firm when moist; slightly calcareous.

20 to 63 inches +, light-gray clay; dark-brown iron mottles; massive (structureless); very hard when dry and very firm when moist; strongly calcareous.

In many places salts are concentrated on the surface in crusts one-fourth inch thick. Where salt crusts do not occur, the surface is cracked in a polygonal pattern. In some areas the surface has a layer of soil, 1 to 2 inches thick, that is light gray or white, is moderately or strongly vesicular, and has moderate, thin or medium, platy structure. The subsoil and the substratum are compact and dense. The substratum contains iron mottles that vary widely in size. Most of the mottles are fine or very fine, but a few are medium or coarse. Below a depth of 48 inches, iron stains the soil in a few horizontal bands. The soil ranges from noncalcareous to strongly calcareous.

This soil is imperfectly drained. Runoff is very slow or none; rainwater normally enters the soil or ponds on the surface and evaporates. Permeability is slow or very slow, and the available water capacity is low. The soil is low in fertility and has a moderately thick root zone. The erosion hazard is no more than slight.

The native vegetation consists mainly of greasewood and scattered patches of saltgrass and suaeda. The plant cover is sparse; some areas are so nearly bare that they resemble playas.

Use and management.—This soil is entirely in range that is used very little. It is not suitable for irrigation, because reclamation would be too costly. As a source of material for engineering uses, it is poor or unsuitable. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Lahontan silt loam, strongly saline-alkali (Lb).—This soil is essentially the same as Lahontan silty clay loam, strongly saline-alkali, but it has a slightly thicker, coarser textured surface layer that is 4 to 8 inches thick.

Use and management.—This soil is used and managed in much the same way as Lahontan silty clay loam, strongly saline-alkali. Its suitability for irrigation, for grazing, and for engineering uses is similar. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Lahontan fine sandy loam, sandy variant, strongly saline-alkali (La).—This soil has a thicker, coarser textured surface layer than Lahontan silty clay loam, strongly saline-alkali, but in other respects it is similar to that soil. The surface layer is about 14 inches thick in undisturbed areas, but it is 8 to 18 inches thick in areas that have been leveled so that irrigation water can be controlled better. The clay subsoil is pale olive and dense, an indication that the soil material was deposited in a shallow lake. This soil is lower on alluvial fans than Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes.

In some places the subsoil contains faint strata of fine sand and sand that are generally 3 inches thick or less.

This soil is imperfectly drained. Permeability in the surface layer is moderately rapid and in the subsoil is very slow. The soil has very slow runoff and very low available water capacity. It is low in fertility and has a shallow root zone, though a few roots penetrate the clay subsoil. Runoff from higher lying soils causes a moderate erosion hazard.

Use and management.—Almost all of this soil is cultivated under irrigation. The rest is used for a feedlot and a stackyard.

Growing crops on this soil is difficult because the concentration of salts and alkali is so strong. Plantings of alfalfa and of barley and other small grain have been unsuccessful. The soil cannot be fully reclaimed, because the clay subsoil prevents leaching of harmful salts. If salt- and alkali-tolerant grasses are grown, their roots may penetrate the subsoil and, in time, thereby allow deep leaching.

Frequent, light irrigations are needed because the soil holds so little available water. Crops respond well to fertilizer, if yields justify its use. Applying manure and growing green-manure crops are effective, particularly if the soil is deep plowed. Reclaiming additional areas of this soil is impractical because soils nearby are more productive. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Lovelock Series

The Lovelock series consists of stratified, medium-textured to fine-textured soils that developed in alluvium deposited at the mouth of streams, where deltas merge with lakebeds. The alluvium was derived from diatomaceous earth, volcanic glass, limestone, basalt, tuff, and reworked lacustrine deposits. These soils occupy slightly concave, nearly level areas in the southernmost part of Lower Valley, adjacent to Humboldt Lake. They occur with Kodak and Ryepatch soils.

While these soils were developing, drainage was poor or very poor, and the vegetation consisted of sedges, tules, and other water-loving plants. The present vegetation in uncultivated areas is mainly saltgrass, bassia, creeping wildrye, and iodineweed or inkweed. Also, there are some willows, tules, and tamarisk in the wetter parts. These plants cover 0 to 25 percent of the surface, depending on how often and how long the soil is flooded and the position of the ground water.

Lovelock soils are calcareous, have a bulk density of less than 1.0, and generally contain the shells of fresh-water mollusks throughout. The surface layer is gray or light gray, is slightly hard or hard, and has granular or subangular blocky structure. The subsoil is light gray, is hard or slightly hard, and has subangular blocky structure. The substratum consists of stratified material that is similar to the surface layer and the subsoil.

Drainage of the Lovelock soils has been somewhat improved. These soils are now poorly drained or imperfectly drained because water from the Humboldt River has been diverted for irrigation, drains have been installed to remove surplus water, and a dike has been built to protect areas of these soils from flooding. In the surface layer the content of organic matter is high. Throughout these soils harmful salts occur in amounts that depend on the extent of irrigation and the adequacy of drainage. The soils also contain alkali, but the lime, the diatomaceous earth, and the organic matter aid in reclamation by counteracting its harmful effects.

Lovelock silt loam, drained (Ld).—This soil occurs in the south-central part of Lower Valley, just east of the pumping station on the Brinkerhoff Ranch. It is not the

most extensive Lovelock soil in the Area, but it is the most important because all of it is cultivated.

Representative profile:

0 to 29 inches, gray to light-gray silt loam, black to gray when moist; granular to subangular blocky structure; hard when dry and very friable or friable when moist; strongly calcareous.

29 to 60 inches +, gray, stratified clay and silty clay, very dark gray when moist; mottled; subangular blocky structure; hard when dry and friable or firm when moist; strongly calcareous.

Mechanical analysis indicates that the surface layer is silty clay or clay rather than silt loam. The soil, however, does not handle or work like clay, because it has a high percentage of diatoms and fragments of volcanic glass that separate with the clay fraction.

This soil is stratified, but the strata are not in an orderly sequence. They range from silt loam to clay in texture and from a few to many inches in thickness. The organic-matter content in the surface layer ranges from 6 to 20 percent; it depends on the length of time the soil has been cultivated and is highest in undisturbed areas. Shells and shell fragments from fresh-water mollusks may occur in any horizon and range from none to many. The water table rises to a depth of 36 to 60 inches during the peak of irrigation, but it falls to a depth of 6 to 8 feet in winter.

This soil is imperfectly drained. Runoff is very slow because rain enters the soil nearly as fast as it falls. Water intake is rapid, permeability is moderate, and the available water capacity is high. Water erosion is not a problem. The soil is high in fertility and has a deep root zone. It is free of harmful salts in the surface layer, but in some places the subsoil contains a slight concentration of soluble salts immediately above the water table.

Use and management.—This irrigated soil is used for small grain grown annually or rotated with alfalfa. The alfalfa is harvested for hay or for a seed crop. Yields are generally good, but at times an early local frost reduces yields of grain and alfalfa seed because air drainage is poor. Crops respond well to fertilizer, including nitrogen and phosphate together or anhydrous ammonia applied in the irrigation water or applied directly to the soil.

All of this soil has been leveled for efficient irrigation. Open drains provide the drainage needed for removing most of the excess water. Complete drainage is not desirable, because the soil may sink and its surface may crack because organic matter is lost through oxidation and the clay strata contract variably as they dry. In some places wind erosion is a moderate hazard if the soil is clean tilled or is left unprotected for a long time, particularly in spring. (Capability unit IIw–0, irrigated)

Lovelock silt loam, hummocky, strongly saline (Lh).—This soil is hummocky and strongly saline but is similar to Lovelock silt loam, drained, in other respects. Past wind action formed the hummocks. They are 2 to 4 feet high and 20 to 50 feet across, and they account for a surface layer that varies from 12 to 48 inches in thickness. In addition, this soil is strongly affected by soluble salts that accumulated at the surface as saline ground water moved upward and evaporated. The soil is now stabilized by a fairly dense stand of saltgrass and bassia that also includes some baltic rush and creeping wildrye. These plants cover 15 to 25 percent of the surface, depending on the salt content of the soil.

Use and management.—All of this soil is in range that is used for grazing in fall, winter, and spring. Water for irrigation is not now available.

If water is made available, this soil can be irrigated and managed like the soils in capability unit IIIw–06. Deep cuts, however, are required in leveling. Also needed is a dike constructed to protect the soil from flooding when the water in Humboldt Lake is abnormally high. An extensive system of drains will lower the water table, but lowering should be only to a depth of 4 or 5 feet. If the water table is lowered beyond this depth, the organic matter in the soil may oxidize rapidly and the soil may shrink and crack when it dries. Harmful salts can be leached away readily if drainage is adequate, because much of the underground water flows laterally through the soil. (Capability unit VIw-6, nonirrigated; Wet Saline Bottoms range site)

Lovelock silt loam, overwashed, strongly saline (Lm).—This soil is similar to Lovelock silt loam, drained, but it is strongly saline and its top layer is lighter colored overwash that was deposited when the Humboldt River flooded and broke the protective dike. This overwash ranges from 2 to 8 inches in thickness. It is light brownish gray when dry, dark grayish brown when moist, and low in organic-matter content. If the soil is deep plowed, this layer will be obliterated. The vegetation is a patchy growth of saltgrass and bassia that covers 0 to 10 percent of the surface.

Use and management.—All of this soil is in range that is used for grazing or is idle.

If water is made available, this soil can be used for irrigated crops and managed like the soils in capability unit IIIw–06. Most of the acreage is protected by the flood-control dike. Before the soil can be successfully cropped, however, it must be leveled and adequately drained. (Capability unit VIw–6, nonirrigated; Wet Saline Bottoms range site)

Lovelock silt loam, occasionally flooded, strongly saline (Lk).—This soil resembles Lovelock silt loam, drained, but is strongly charged with soluble salts, is affected by a water table that occurs within 20 to 36 inches of the surface in normal years, and is occasionally flooded for a long time when runoff is abnormally high. This soil lies adjacent to Humboldt Lake and is one of the most extensive Lovelock soils in the Area. The vegetation consists mainly of saltgrass, and there is some bassia, iodineweed, tamarisk, willow, tule, creeping wildrye, and heliotrope. From 0 to 25 percent of the surface is covered by these plants.

Use and management.—Little agricultural use is made of this soil. Nearly all the acreage is in range that provides some grazing, but large areas are barren.

This soil can be made suitable for irrigation if water becomes available. It would be managed about the same as are the soils in capability unit IIIw–06. A protective dike is needed to prevent flooding when the Humboldt River is exceptionally high and causes the lake to rise and expand. Also needed are land leveling, irrigation canals and ditches, an extensive system of drains, and the leaching of salts. All crops grown locally are suited if the salt content is lowered. (Capability unit VIw–6, nonirrigated; Wet Saline Bottoms range site)

Lovelock silt loam, slightly saline (Lf).—This soil is essentially the same as Lovelock silt loam, drained, except

that it is slightly saline and is affected by a water table that fluctuates between depths of 18 to 30 inches during the peak of the irrigation season. The water table is so near the surface that deep leaching is impossible. As rapidly as salts are leached out of the surface layer, they are returned through the capillary rise of saline ground water.

Use and management.—Small grain is grown on this soil year after year. Its yields are only about one-half those produced on salt-free Lovelock soils. Management is similar to that for Lovelock silt loam, drained.

Artificial drainage on this soil is incomplete. Recently the drains were deepened, and a new pumping station was installed at the point where excess water is pumped over the flood-control dike and discharged into a drain that leads to Humboldt Lake. A new drainage outlet is needed, however, so that drains can be excavated to a greater depth and placed on an adequate grade. These improvements are expected to lower the water table 2 to 3 feet, to permit the leaching of salts, and, as a result, to improve the yields of crops. (Capability unit IIIw-06, irrigated)

Lovelock silt loam, strongly saline (Lg).—This soil has a water table at a depth of 18 to 36 inches and contains a large amount of soluble salts that accumulated as saline ground water rose and evaporated. Otherwise, it is similar to Lovelock silt loam, drained. A fairly dense stand of saltgrass and bassia makes up the vegetation and covers 15 to 25 percent of the surface (fig. 4).

Use and management.—All of this soil is in range that is grazed by livestock.

If water is made available and ditches are provided, this soil can be drained, leveled, and irrigated. It would be managed in about the same way as the soils in capability unit IIIw-06. After some of the toxic salts are removed by leaching, the soil will be suited to most crops tolerant of salts and suited to the Area. (Capability unit VIw-6, nonirrigated; Wet Saline Bottoms range site)

Lovelock silt loam, shallow over clay, drained (Lp).—This soil occurs in the area of transition between Lovelock and Ryepatch soils. It is underlain, at a depth of 14 to 20 inches, by slowly permeable clay that closely resembles the clay layers in Ryepatch soils. In other respects, it is similar to Lovelock silt loam, drained.

Use and management.—This soil is suited to all crops that are suited to the Area. It is generally used for small grain and alfalfa grown in rotation.

Drains must be maintained and irrigation water applied carefully to avoid a perched water table over the clay layer, to prevent the accumulation of salts in the surface layer, and to keep the soil from drying completely. If the soil dries in winter, it commonly shrinks and forms cracks that can interfere with the first irrigation of the season, though they disappear as the underlying clay expands on wetting.

Alfalfa responds well to fertilizer that contains nitrogen and phosphate; small grain responds well to anhydrous ammonia. Returning crop residue to the soil and applying manure increase the intake of water, improve tilth, and maintain the organic-matter content.

In years when water is not available, wind erosion can be controlled if crop stubble is left standing and if the surface is made cloddy through deep plowing. Because the surface layer has low bulk density, it is likely to blow if left unprotected for a long time. (Capability unit IIw-03, irrigated)

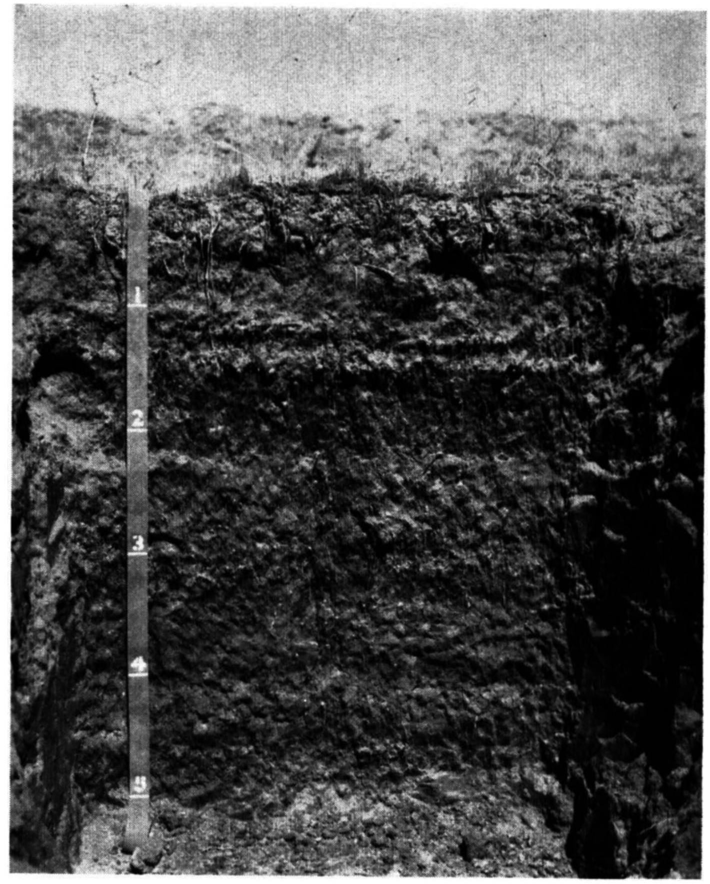

Figure 4.—Profile of Lovelock silt loam, strongly saline. Note the strata that make up this soil, and the ashy bands.

Lovelock silt loam, shallow over clay, strongly saline (Lr).—This soil is essentially the same as Lovelock silt loam, shallow over clay, drained, but is strongly saline and has a water table at a depth of 18 to 36 inches. The native vegetation is dominantly saltgrass, and there is some bassia, creeping wildrye, and greasewood. The density of these plants ranges from 10 to 15 percent.

Use and management.—All of this soil is in range, but only a small acreage is grazed. Water is not now available for irrigation.

This soil can easily be irrigated if water is made available. Land leveling, adequate drains, and irrigation ditches are needed if the soil is irrigated. Management would be about the same as that for the soils in capability unit IIIw-036, irrigated. After the salt content has been reduced, most salt-tolerant crops suited to the Area can safely be grown. (Capability unit VIw-6, nonirrigated; Wet Saline Bottoms range site)

Lovelock silt loam, hummocky, shallow over clay, strongly saline (Ls).—This soil is essentially the same as Lovelock silt loam, shallow over clay, drained, except for strong salinity and a hummocky surface. The hummocks, 2 to 4 feet high and as much as several feet across, formed around shrubs when wind deposited silty material. The native vegetation is mainly greasewood and a few colonies of saltgrass. These plants cover 2 to 7 percent of the surface.

Use and management.—Irrigation water is not now available for this soil, which is entirely in range. If water is made available, this soil can be leveled, drained, reclaimed, and used for irrigated crops. It would be managed in about the same way as the soils in capability unit IIIw–036, irrigated. After the salinity is reduced, most salt-tolerant crops suited to the Area can be grown. (Capability unit VIw–6, nonirrigated; Wet Saline Bottoms range site)

Lovelock silt loam, moderately deep over clay, drained (Ln).—Except that the clay layer occurs at a depth of 20 to 36 inches, this soil is similar to Lovelock silt loam, shallow over clay, drained.

Use and management.—This soil is used and managed in much the same way as Lovelock silt loam, shallow over clay, drained. (Capability unit IIw–03, irrigated)

Lovelock silt loam, moderately deep over clay, drained, slightly saline (Lo).—Except that it is slightly saline and overlies buried clay at a depth of 20 to 36 inches, this soil is similar to Lovelock silt loam, shallow over clay, drained.

Use and management.—This soil is drained, partly reclaimed, and used for small grain and alfalfa grown in rotation. These crops tolerate slight salinity, but they produce lower yields on this soil than on salt-free Lovelock soils.

A large amount of water, applied periodically, will remove the excess salts. In some areas the drains should be deepened. If salts are leached out, the soil will be suited to more kinds of crops. (Capability unit IIIw–036, irrigated)

Mazuma Series

The Mazuma series consists of well-drained, moderately coarse textured, saline-alkali soils that developed in alluvium washed from basalt, rhyolite, tuff, limestone, and sediments laid down in ancient Lake Lahontan. These soils occupy the lower part of smooth, nearly level, broad alluvial fans. They are in the western part of Upper Valley and occur with Bluewing and Placeritos soils. The vegetation is mainly upland greasewood, and there is some shadscale and suaeda. From 5 to 15 percent of the ground surface is covered by plants.

These soils are very deep to shallow over dense lacustrine clay and are calcareous throughout that depth. The surface layer is very pale brown to light grayish brown, is hard or slightly hard, and has platy structure. The subsoil is pale brown to very pale brown, is slightly hard, and has subangular blocky structure. The substratum is pale brown or very pale brown, stratified, and loose to slightly hard. It has platy structure or is single grained. In some places the underlying material consists of lacustrine clay that is pale olive, very hard, and massive. In other places it consists of very gravelly coarse sand that is light brownish gray and strongly calcareous.

Most areas of these soils are not cultivated, because they are too high for water to flow from existing irrigation ditches. These areas provide limited grazing for livestock.

Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes (MaA).—This soil occurs in the western part of Upper Valley. Its surface generally is uniform or slightly convex, but there are many wind-deposited hummocks, 18 to 24 inches high, that have formed from material accumulated at the base of shrubs. The soil is crossed by broad and shallow channels, 4 to 12 inches deep, that were formed by the intermittent flow of drainage water.

Representative profile:

0 to 8 inches, light grayish-brown fine sandy loam; platy structure; slightly hard when dry and friable when moist; slightly calcareous.

8 to 30 inches, very pale brown fine sandy loam; subangular blocky structure; slightly hard when dry and very friable when moist; strongly calcareous.

30 to 60 inches, very pale brown very fine sandy loam; platy structure; slightly hard when dry and very friable when moist; strongly calcareous.

Throughout the soil, strata range from medium to coarse in texture but are chiefly moderately coarse. Strata containing fine or medium-sized segregations of lime are common in the substratum in many places. Lime occurs in variable amounts throughout the soil, except in the coarse-textured strata.

This soil is low in natural fertility and has a very thick root zone. Drainage is good, runoff is very slow in periods of normal rainfall, and the permeability is moderately rapid. The available water capacity is low because of the strong concentrations of salts and alkali. Runoff from higher lying soils causes a moderate hazard of erosion.

The native vegetation is dominantly upland greasewood, and there are scattered shadscale and suaeda plants. From 10 to 15 percent of the surface is covered by vegetation.

Use and management.—All of this soil is in range. Its grazing use is limited but could be more intensive if stockwater were provided.

This soil probably will not be irrigated in the foreseeable future. It is too high for irrigation from existing ditches, and any water that is made available must be pumped from ground water. A small amount of material for construction is obtained from this soil. (Capability unit VIIs–6, nonirrigated; Alkali Flats range site)

Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes (McA).—This soil occupies lower positions on alluvial fans than Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes. It is essentially the same as that soil but is underlain, at a depth of 20 to 36 inches, by dense clay that is very slowly permeable to water and plant roots.

In some places the substratum contains strata of sand or coarse sand, generally 3 inches thick or less. Stratified sand and very fine gravel predominate below a depth of 9 feet and can be seen in a well dug by hand in this soil.

Drainage is good, runoff is very slow, and the available water capacity is low. Permeability is moderately rapid above the clay and is very slow in it. The soil is low in fertility and has a root zone that extends to a depth of 20 to 36 inches. Because of runoff from higher soils, the erosion hazard is moderate.

The native vegetation is mainly greasewood, and there are scattered suaeda plants. The density of the vegetation ranges from 5 to 10 percent.

Use and management.—This soil is used and managed in about the same way as Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes.

By using an abandoned highline ditch, water from the Humboldt River can be made available for irrigating a small acreage of this soil. If the water is made available,

only those grasses that are most tolerant of salts and alkali should be grown. However, because this soil cannot be adequately drained, salts and alkali will continue to be a problem, and it would be more practical to use the water on better soils.

A small amount of material for construction is obtained from this soil. (Capability unit VIIs-6, nonirrigated; Alkali Flats range site)

Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes (MgC).—This soil occupies the sides of old offshore terraces and occurs with the Toulon soils. It is somewhat similar to Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes, but is more strongly sloping, is free of excess salts and alkali, and is underlain by loose gravel. The vegetation covers 3 to 5 percent of the soil surface and consists of shadscale, upland greasewood, bud sagebrush, and halogeton.

The surface layer and the subsoil are dominantly fine sandy loam, but they vary in texture and also in thickness. In some places the content of gravel varies slightly, and in others the subsoil and the upper part of the underlying layer of gravel contain a small amount of crystalline gypsum. The underlying gravel is at a depth of 18 to 36 inches. It consists of coarse textured or very coarse textured material that is stratified in some places.

Drainage is good, and runoff is very slow. Permeability is moderately rapid in the surface layer and the subsoil and is very rapid in the underlying gravel. The soil is low in available water capacity and is moderately fertile. Roots penetrate very deeply. Erosion is a moderate hazard.

Use and management.—All of this soil, except areas used to supply sand and gravel for construction, is in range. In the past the vegetation provided limited grazing for sheep in winter, but now little use is made of it. The underlying layer supplies excellent sand and gravel that is used as ballast along the main line of the Southern Pacific Railroad, as material in highway construction, and as aggregate in concrete. (Capability unit VIIs-4, nonirrigated; Desert Uplands range site)

Ocala Series

The Ocala series consists of moderately fine textured, poorly drained, saline-alkali soils that developed in alluvium washed chiefly from limestone, basalt, tuff, and lacustrine sediments. These soils are on the smooth, nearly level flood plain of the Humboldt River in Lower Valley near the Big Five Reservoir. They occur with Placeritos, Lahontan, and Sonoma soils. The vegetation is mainly saltgrass, and there is some greasewood and suaeda. These plants cover 10 to 20 percent of the soil surface, depending on how much salt the soil contains.

The Ocala soils are very deep and are calcareous throughout. The surface layer is light gray, stratified, hard, and platy in structure. The light-gray subsoil is hard and has angular or subangular blocky structure. The substratum is light gray, hard to very hard, and massive; it is weakly cemented by alkali-soluble materials.

Ocala loam, strongly saline-alkali (Om).—This soil is in the eastern part of Lower Valley, about one-half mile north of Big Five Reservoir. It lies adjacent to the Humboldt River and about 10 feet below its level. Seepage from the river feeds the ground water, causes poor drainage, and contributes to the accumulation of salts and alkali.

Representative profile:

0 to 10 inches, light-gray loam, olive when moist; platy structure; hard when dry and friable when moist; strongly calcareous.

10 to 14 inches, light-gray silty clay loam, olive gray when moist; angular and subangular blocky structure; hard when dry and firm when moist; strongly calcareous.

14 to 26 inches +, light-gray light silty clay loam, dark grayish brown when moist; contains fragments of hardpan weakly cemented with silica; hard or very hard when dry and firm when moist; strongly calcareous.

The depth to the substratum ranges from 12 to 30 inches but is generally 12 to 18 inches. The substratum is mainly silty clay loam, but it ranges to very fine sandy loam. In some places it is moderately cemented and has thin, essentially platy structure. The substratum contains firm nodules where it is weakly cemented. In most areas the water table is within 18 to 36 inches of the surface. In areas where the Humboldt River is entrenched in its channel, however, the water table occurs at a depth of as much as 48 inches.

This soil is poorly drained. Runoff is very slow. Much of the rainwater ponds on the surface and evaporates. The soil is slow in permeability and is low in fertility. Because of excessive salts and alkali, the available water capacity is low. Root penetration is shallow to moderately deep. The growth of roots is hindered by the hardpan and the water table. The erosion hazard is slight.

Use and management.—All of the acreage of this soil is in range that provides spring and summer grazing for livestock. No water is available for irrigation. The soil is not suitable as a source of material for most engineering uses. (Capability unit VIw-6, nonirrigated; Wet Saline Bottoms range site)

Placeritos Series

The Placeritos series consists of imperfectly drained, stratified, medium-textured soils that developed in alluvium washed chiefly from limestone, tuff, basalt, and lacustrine deposits. These soils are on smooth, nearly level flood plains, and alluvial fans in the eastern, the northern, and western parts of Lovelock Valley. They occur with Sonoma and Quincy soils. The vegetation on the flood plain is dominantly greasewood and saltbush, and there is an understory of saltgrass and creeping wildrye except in areas that are better drained. On alluvial fans the main plants are shadscale, bud sagebrush, and Douglas rabbitbrush. The plants cover from 5 to 20 percent of the acreage, depending on the salt and alkali content of the soil.

These soils are very deep and are calcareous throughout. The surface soil is very dark grayish brown when moist and is massive or is subangular blocky and granular in structure. The subsoil and the substratum are dominantly dark grayish brown when moist. They are friable and are massive or have subangular blocky and granular structure. In places the substratum contains silty clay loam, clay, or sand. Some areas are free of excess salts and alkali, but others are slightly to strongly affected.

A relatively large acreage of these soils is used for all irrigated crops grown locally. The rest is used for limited

livestock grazing, farmsteads, feedlots, and stackyards, or is idle.

Placeritos loam (Pa).—This nearly level, imperfectly drained soil occurs east of Lovelock on the flood plain along the Humboldt River.

Representative profile:

0 to 6 inches, loam, very dark grayish brown when moist; massive (structureless) or subangular blocky and granular structure; slightly hard when dry and friable when moist; moderately calcareous.

6 to 60 inches +, stratified silt loam, loam, and silty clay, dark grayish brown when moist; mottled below a depth of 13 inches; massive or subangular blocky and granular structure; slightly hard when dry and friable to firm when moist; slightly to moderately calcareous.

The strata in the subsoil and the substratum are not in an orderly sequence of texture or thickness. The texture is dominantly loam or silt loam, but in places it is clayey or sandy. In some places the substratum contains a few, small concretions of lime below a depth of 48 inches. A small or moderate amount of lime occurs throughout the soil, and in places the lime is finely segregated. The water table occurs at a depth of 4 to 6 feet during the peak of the irrigation season. Small amounts of salts and alkali have accumulated between a depth of 36 inches and the water table.

Runoff from this soil is very slow. Permeability is moderate. The soil has a high available water capacity, is high in fertility, and has a very deep root zone. The erosion hazard is only slight.

Use and management.—All of this soil is used for irrigated crops that are suited to the Area. Crops respond well to added fertilizer, including nitrogen alone or nitrogen combined with phosphate. Applications of manure help to keep the soil in good tilth and to increase the intake of water.

In irrigating this soil, care must be taken to avoid raising the water table. Overirrigation builds up the ground water, which brings dissolved salts up into the root zone. Occasionally, however, a heavy application of water is needed to leach salts from the soil and thereby to maintain a favorable salt balance. The excess water used in leaching can be removed through deep drains, which help to keep the water table at a safe level. Deep cuts can be made in leveling fields so that irrigation is efficient.

Plowing this soil at the same depth is likely to form a plowpan, or compacted layer, just below plow depth. By varying the depth of plowing from time to time, a plowpan can be avoided. This soil should not be tilled more than is necessary. (Capability unit IIw–2, irrigated)

Placeritos loam, drained (Pd).—This soil is well drained because it occurs in areas that are drained by deep ditches or by the Humboldt River. During the peak of the irrigation season, this drainage keeps the water table from rising nearer to the surface than 6 to 9 feet. The soil has a very deep root zone, and in most places, it is free of harmful salts and alkali to a depth of 5 feet. Otherwise, it is essentially the same as Placeritos loam. The vegetation consists mainly of shadscale, bud sagebrush, and Douglas rabbitbrush, and it covers 5 to 10 percent of the soil surface.

Use and management.—In the northern part of the Lovelock Valley, an area of this soil is so high that irrigation water cannot flow to it from existing canals. This area is used for limited grazing. The rest of this soil is used and managed in much the same way as Placeritos loam.

Cleaning and maintenance of drains are needed, for the drains are much less effective if they are choked with aquatic plants and with soil material that sloughs from the banks. (Capability unit I–A, irrigated; VIIc–K, nonirrigated; Desert Uplands range site)

Placeritos loam, slightly saline-alkali (Pf).—This soil is similar to Placeritos loam, but it is slightly affected by salts and alkali. In most places the surface layer is affected. In some places, however, the surface layer is nonsaline and nonalkali and the subsoil contains moderate amounts of salts and alkali that reduce permeability and the penetration of plant roots. Included with this soil are areas that have a fine sandy loam surface layer about 8 inches thick.

Use and management.—This soil is used for all crops grown locally. It is best suited to crops that are tolerant of salts and alkali. Yields of grass used for pasture are high, but corn yields are poor or very poor. Cropping systems should include only those crops that are salt and alkali tolerant.

Deep drains are needed to dispose of excess water and to lower the water table so that heavy irrigations can be used to leach away harmful salts. Applying gypsum or sulfur reduces the alkali content and increases permeability. Cuts can be deep in fields that are leveled to improve irrigation. (Capability unit IIw–6, irrigated)

Placeritos loam, strongly saline-alkali (Pg).—This soil is essentially the same as Placeritos loam, but it is strongly affected by salts and alkali that were concentrated on the surface by plants and by the rise and the evaporation of ground water. A profile of this soil is shown in figure 5. Included with this soil are areas that have a fine sandy loam surface layer about 8 inches thick.

The native vegetation consists mainly of greasewood and saltbush, and there is an understory of saltgrass, creeping wildrye, and some baltic rush. These plants cover 10 to 20 percent of the surface, depending on the amount of salts and alkali in the soil.

Figure 5.—Profile of Placeritos loam, strongly saline-alkali. This soil is clearly stratified but is massive, or structureless.

Use and management.—Most of this soil is in range that is used for limited grazing, and small areas are used for stackyards or feedlots. Attempts have been made to improve the soil where irrigation water could be obtained. The results have ranged from success to failure, depending on the adequacy of drainage and the concentration of salts and alkali.

Reclaiming this soil is feasible if more water is made available for irrigation. If the soil is irrigated, it would be managed in about the same way as are the soils in capability unit IIw–6, irrigated. Among the practices needed to make this soil suitable for irrigation are land leveling, constructing irrigation ditches, and installing deep drains. Gypsum or sulfur can be applied to reduce the harmful effects of alkali and to increase permeability, but heavy irrigations are needed to flush away the soluble salts. During reclamation, only the crops most tolerant of salts and alkali should be planted. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Placeritos loam, drained, strongly saline-alkali (Ph).—This soil occupies areas that are drained by the Humboldt River and are little affected by excess water that seeps from canals and from irrigated fields. As a consequence, the water table is lower in this soil than in Placeritos loam. During the peak of the irrigation season, the water table generally occurs at a depth of 6 to 9 feet. Excessive salts and alkali have been concentrated in the soil by plants and by saline water that evaporated when the alluvium was deposited. The vegetation is mainly greasewood and saltbush. These plants cover 10 to 20 percent of the surface.

Use and management.—All of this soil is in range that is used for grazing. Water for irrigation is not now available.

This soil can be reclaimed and irrigated if water is made available. The reclamation needed consists of land leveling, constructing canals and ditches, installing deep drains, using a large amount of water to leach away salts, and applying gypsum or sulfur to lower the alkali content and to maintain soil permeability. Reclamation will likely be slow and will cause a temporary rise in the water table. While improvement is underway, only the crops most tolerant of salts and alkali should be grown. If the soil is reclaimed, it would be managed in about the same way as are the soils in capability unit IIw–6, irrigated. (Capability unit VIIs–6, nonirrigated; Alkali Flats range site)

Placeritos loam, over clay, drained, strongly saline-alkali (Pk).—This soil occupies a low terrace in the northwestern part of the Lovelock Area. It is similar to Placeritos loam but is strongly affected by salts and alkali and has a substratum of dense clay that was deposited in prehistoric Lake Lahontan. The substratum is very slowly permeable to water. The water table occurs at a depth of 6 to 9 feet. Greasewood makes up most of the vegetation, which covers about 10 percent of the surface.

The depth to the substratum ranges from 48 to 62 inches. In places the substratum contains fine sand and sand in strata ½ to 3 inches thick. Near the upper surface of the substratum, in many places, there are vertical cracks that contain material from the subsoil. These cracks are generally about 1/16 inch wide but are as much as ½ inch wide in some places.

Use and management.—All of this soil is in range. None of it is cultivated, for water is not now available for irrigation.

If water is provided, this soil can be used for irrigated grasses that are tolerant of salts and alkali. Land leveling and ditching are required to prepare the soil for irrigation. The soil can be greatly improved by installing shallow drains in some places and by applying gypsum or sulfur to increase permeability in the surface layer and to reduce the content of alkali. Deep drains are not suitable, because the substratum is very slowly permeable. If this soil were irrigated, it would be managed in about the same way as the soils in capability unit IIIw–36, irrigated. (Capability unit VIIs–6, nonirrigated; Alkali Flats range site)

Placeritos loam, over sand, slightly saline-alkali (Pp).—Throughout Upper and Lower Valleys, this soil occurs in old stream channels, 10 to 50 feet wide, that dissect Sonoma soils and other Placeritos soils. It is similar to Placeritos loam but is underlain by stratified sand, is slightly affected by salts and alkali, and has a low available water capacity.

The depth to the substratum ranges from 12 to 48 inches, but in most places it is between 20 and 26 inches. The substratum varies widely in degree of stratification and mottling. In texture it ranges from sand to loamy fine sand, and strata of gravelly coarse sand or gravel are common. Medium and coarse iron-stained mottles range from few in some places to many in others.

Use and management.—This soil is used entirely for irrigated crops that are suited to the Area. It occurs in small areas and is used and managed like the surrounding soils, but it has a lower available water capacity than these soils and retains moisture for a shorter period. It is irrigated at the same time as the adjoining soils and dries so much between irrigations that crop yields are only poor or fair, depending on the depth of the sand substratum.

This soil is important where it occurs in areas that require drainage. The substratum, acting as an acquifer, receives water and transmits it readily. If drains are placed to intercept this flow, they function effectively. Irrigation ditches and canals that cross this soil lose excessive water through seepage and should be lined. Gypsum or sulfur can be used to reduce the alkali content in the soil. (Capability unit IIIw–46, irrigated)

Placeritos loam, over sand (Po).—Because water flows through the substratum laterally, harmful salts are prevented from accumulating in this soil. Consequently, the soil is generally free of excess salts and alkali, but in other respects it is similar to Placeritos loam, over sand, slightly saline-alkali.

Use and management.—This soil is used and managed in much the same way as Placeritos loam, over sand, slightly saline-alkali. Crop yields are slightly higher because they are not affected by salts and alkali in toxic amounts (Capability unit IIIw–4, irrigated)

Placeritos loam, over sand, strongly saline-alkali (Pr).—Except that it is strongly affected by salts and alkali, this soil is about the same as Placeritos loam, over sand, slightly saline-alkali. Figure 6 shows a profile of this soil. Greasewood and rabbitbrush dominate the vegetation, and there is an understory of saltgrass, wiregrass, and some creeping wildrye. These plants cover 10 to 20 percent of the surface.

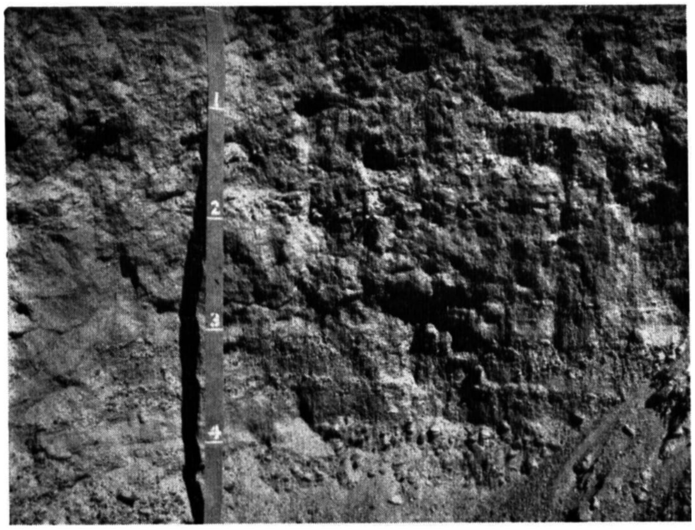

Figure 6.—Profile of Placeritos loam, over sand, strongly saline-alkali. Below a depth of 24 inches, the soil is stratified loamy fine sand, sand, and gravel.

Use and management.—Because irrigation water is not available, most areas of this soil are in range that is used for limited grazing in spring, summer, and winter. A few areas are irrigated and are used and managed in about the same way as the soil in capability unit IIIw-46. (Capability unit VIIw-6, nonirrigated; Alkali Flats range site)

Placeritos loam, over silty clay loam, drained, strongly saline-alkali (Pn).—This soil occurs mainly on the eastern side of Lower Valley in the area of transition between Placeritos and Sonoma soils. Its substratum is dominantly silty clay loam that is moderately slow in permeability. Strong concentrations of salts and alkali have accumulated through the action of plants and the evaporation of saline water. In addition, the water table is 6 to 9 feet below the surface during the peak of the irrigation season. Several included areas have a 6-inch surface layer of fine sandy loam. In other respects, this soil is similar to Placeritos loam. From 10 to 15 percent of the surface is covered by plants, mainly greasewood and saltbush.

The substratum is 22 to 40 inches from the surface and includes a few lenses of silt loam and silty clay.

Use and management.—This soil is not cultivated, because water is not available for irrigation. It can be reclaimed, leveled, and irrigated if water can be obtained and if adequate drainage is provided. After reclamation, it would be managed in about the same way as are the soils in capability unit IIw-6, irrigated. Deep leaching and applications of gypsum or sulfur are needed to reduce the alkali content in the soil and to increase permeability. Deep drains would dispose of the excess water used in leaching and would help to avoid a perched water table over the substratum. While reclamation is underway, only the crops most tolerant of salts and alkali should be grown. (Capability unit VIIs-6, nonirrigated; Alkali Flats range site)

Placeritos loam, over silty clay loam, slightly saline-alkali (Pm).—This soil has a water table at a depth of 4 to 6 feet. It is slightly affected by excess salts and alkali in the surface layer and is moderately or strongly affected in the subsoil or in the upper part of the substratum, just above the capillary fringe of the water table. Included are several areas that have an 8-inch surface layer of fine sandy loam. In other respects, this soil is similar to Placeritos loam, over silty clay loam, drained, strongly saline-alkali.

Use and management.—This soil is cultivated under irrigation and is suited to most crops grown locally. Crops produce only fair yields but respond well to fertilizer, particularly to nitrogen and phosphate together. Applying manure and turning under crop residue increase water intake, improve tilth, and increase the organic-matter content.

Deep irrigation of this soil is almost impossible because the substratum contains so much alkali. If the alkali content is reduced through the addition of sulfur or gypsum, the soil can be wet into the substratum and will likely be more productive. Adequate drainage must be provided to lower the water table and to remove the surplus water used in leaching soluble salts. (Capability unit IIw-6, irrigated)

Placeritos loam, terrace, strongly saline-alkali (Ps).—This nearly level soil occupies high terraces along the eastern side of Upper Valley. It is strongly affected by salts and alkali and has a stratified substratum that formed in material deposited in prehistoric Lake Lahontan (fig 7). A water table is lacking to a depth of more than 15 feet. Otherwise, this soil is similar to Placeritos loam, over sand, slightly saline-alkali. Greasewood occurs in nearly pure stands and covers about 10 percent of the soil surface.

The strata that make up the substratum do not occur in an orderly sequence. They range from clay to gravel and are ½ to 20 inches thick. Generally, the fine-textured strata are less than 2 inches thick, and those that consist of sand and gravel are thicker. Pits about 15 feet deep show that the gravel content increases below a depth of 5 feet.

Use and management.—Irrigation water is not available for this soil, and most areas are of limited use as range.

Figure 7.—Profile of Placeritos loam, terrace, strongly saline-alkali. Below a depth of 30 inches, the soil is mainly stratified sand, but some strata contain a large amount of gravel.

A few areas are used as industrial sites, and in some places part of the soil is used for construction material. As a source of sand and gravel, the surface layer and the subsoil are poor, and the substratum is fair to a depth of 5 feet. Below that depth, the substratum is a good source of gravel. (Capability unit VIIs-6, nonirrigated; Alkali Flats range site)

Quincy Series

The Quincy series consists of excessively drained, coarse-textured soils that formed in materials blown from alluvium and from the residuum of many kinds of weathered rocks. These materials consist mainly of medium and fine sand high in quartz, and partly of feldspar, mica, and ferromagnesian minerals. Quincy soils are in rolling areas of partly stabilized sand dunes. These dunes have nearly level to strong slopes. They lie on the flood plain, where the Quincy soils occur with the Placeritos and Sonoma soils. The vegetation is mostly greasewood, dahlia, rabbitbrush, and Indian ricegrass. These plants cover 5 to 15 percent of the ground surface.

These soils are generally very deep and are noncalcareous throughout. The surface soil, subsoil, and substratum are light brownish gray, loose, and single grained. In spots the subsoil and substratum are slightly calcareous. In places alluvial sediments underlie Quincy soils at a depth of 18 to 40 inches.

Most areas of Quincy soils are in range that is used for limited grazing in winter. Small areas are under irrigation and are used for alfalfa, potatoes, small grain, and pasture. Generally, the irrigated soils are those that overlie alluvial material.

Quincy fine sand, 0 to 15 percent slopes (QfD).—Most of this soil occurs in two large areas, one east of the town of Lovelock and the other south of it. Smaller areas are scattered along the east and west sides of the survey area. The native vegetation is mainly greasewood, dahlia, rabbitbrush, and Indian ricegrass. These plants cover 5 to 15 percent of the soil surface.

Representative profile:

0 to 6 inches, light brownish-gray fine sand; single grained; loose when dry and when moist; noncalcareous.

6 to 60 inches, light brownish-gray fine sand; single grained; loose when dry and when moist; slightly calcareous in spots.

In a few places this soil is mildly calcareous, but in most places it is noncalcareous throughout. Areas are included that are sand instead of fine sand.

Natural drainage is excessive, and surface runoff is very slow. Infiltration of water and permeability are very rapid. The available water capacity and the natural fertility are very low. The hazard of erosion, especially wind erosion, is severe if the native plants are removed.

Use and management.—All of this soil is in range that provides a fair amount of winter forage for livestock. It is unlikely that the soil will be irrigated, even if water should be made available, because leveling is too costly. The soil is a poor source of material for construction, since much of the sand is too fine. (Capability unit VIIs-L, nonirrigated; Sand Hills range site)

Quincy fine sand, over silty clay loam, 0 to 2 percent slopes (QtA).—In areas that are scattered throughout the eastern and northern parts of Lovelock Valley, this soil occurs where sand dunes have been leveled in an attempt to establish irrigation. It is underlain, at a depth of 18 to 40 inches, by silty clay loam that is strongly calcareous and closely resembles Sonoma soils. Otherwise, it is similar to Quincy fine sand, 0 to 15 percent slopes.

The underlying material varies in texture as a result of stratification. It is dominantly silty clay loam but ranges to very fine sandy loam.

This soil is well drained. Runoff is very slow. Permeability is very rapid above the underlying material and is moderately slow in it. The soil is moderate in available water capacity but is low in fertility. Roots penetrate very deeply. Wind causes a severe erosion hazard if the soil is left unprotected.

Use and management.—Some of this soil is used for irrigated crops that are suited to the Area. Yields of potatoes and other row crops are good. Alfalfa and grass produce fairly well, but yields of small grain are poor. Where irrigation water is scarce, some fields are idle.

This soil must be irrigated carefully because the underlying silty clay loam is moderately slow in permeability. If the soil is overirrigated, the excess water forms a perched water table that causes rotting in the taproots of alfalfa. Short irrigation runs and frequent, light applications of water are desirable.

Manure and fertilizer applied in large amounts are necessary for satisfactory yields of crops. Using manure and returning crop residue to the soil increase the content of organic matter, help to maintain good tilth, and reduce the erosion hazard. (Capability unit IIIs-L, irrigated)

Ryepatch Series

The Ryepatch series consists of imperfectly drained, fine-textured soils that developed in alluvium washed from limestone, basalt, and tuff and from reworked, fine-textured lacustrine deposits. These soils are on smooth, nearly level, deltaic flood plains and lakebeds. They occur in the south-central part of Lower Valley and occur with Humboldt and Lovelock soils. The vegetation is dominantly greasewood and saltbush, and there is an understory of saltgrass, creeping wildrye, and alkali sacaton. Plants cover 10 to 20 percent of the soil surface, depending on the concentration of salts and alkali.

These soils are very deep, are calcareous, have a clay fraction in excess of 55 percent, and have moderate to strong structure. The surface layer is black or very dark gray, slightly hard, and subangular blocky in structure. The subsoil is black to dark olive gray, hard, and subangular in structure. The substratum is light olive gray or gray, very hard, and subangular blocky in structure.

Nearly the entire acreage of these soils is farmed intensively. Alfalfa, pasture, small grain, and corn for silage are the principal crops.

Ryepatch silty clay (Ra).—Several large areas of this soil are in Lower Valley south of Lovelock.

Representative profile:

0 to 10 inches, silty clay, black when moist; subangular blocky structure; slightly hard when dry and friable when moist; slightly calcareous.

10 to 39 inches, clay, black to dark olive gray when moist; mottled; subangular blocky structure; hard when dry and firm when moist; slightly calcareous.

39 to 65 inches +, stratified clay, light olive gray when moist; mottled; subangular blocky structure; hard when dry and firm when moist; slightly calcareous.

The surface layer ranges from 8 to 20 inches in thickness and is very dark gray or black when moist. The subsoil and the substratum include strata of silt loam or silty clay, 2 to 5 inches thick. A few concretions of calcium carbonate occur in the substratum. In some places the soil contains the shells of fresh-water mollusks and a small amount of crystalline gypsum. During the peak of the irrigation season, the water table rises to within 4 to 6 feet of the surface. The substratum contains a slight concentration of salts just above the capillary fringe of the water table.

Although the natural drainage was poor, this soil is now imperfectly drained as a result of irrigation and artificial drainage in the valley. It has very slow runoff, is slow in infiltration and permeability, and is high in available water capacity. Roots penetrate deeply. The natural fertility and the organic-matter content are high. Erosion is not a problem.

Use and management.—Where sufficient water is available for irrigation, this soil is suited to all crops grown locally. Crop yields are good, though potatoes and other row crops are slightly affected at times by the surface layer, which tends to swell when wet. Small grain and alfalfa respond well to added fertilizer, especially nitrogen and phosphate together. Excessive cultivation is likely to reduce the content of organic matter. The supply of organic matter can be maintained by applying manure, by using a systematic crop rotation, and by turning under manure and crop residue at the end of each rotation.

To keep the infiltration of water at its present rate, this soil should be tilled carefully. For good control and use of water, leveling is needed in some fields. Deep cuts can be made without impairing the longtime productivity of the soil.

Deep drains, properly maintained, provide the drainage required to remove excess water, control the water table, and thereby help maintain a favorable salt balance in the soil. Except for an occasional heavy irrigation to remove excess salts, care in irrigation is essential to avoid a buildup of the water table and an accumulation of salts in the upper part of the soil. (Capability unit IIw-35, irrigated)

Ryepatch silty clay, drained (Rd).—The water table in this artificially drained soil has been lowered to a depth of 6 to 9 feet. The profile is generally free of excess salts and alkali throughout. In other respects, this soil is similar to Ryepatch silty clay.

Use and management.—This soil is used and managed in about the same way as Ryepatch silty clay. It produces slightly higher yields of crops because the lower water table results in a thicker root zone. Drains must be maintained to keep the water table at a safe level. (Capability unit IIw-35, irrigated)

Ryepatch silty clay, slightly saline-alkali (Rh).—Although this soil has been partially reclaimed, the surface layer is still slightly affected by excess salts and by alkali that reduce the intake of water. In some places the lower subsoil and the substratum are moderately affected. Otherwise, this soil is similar to Ryepatch silty clay.

Use and management.—All irrigated crops suited to the Area are grown on this soil. Crops that are tolerant of excess salts and alkali have fairly good yields, but other crops have poor ones. Among the best crops for improving the soil are salt- and alkali-tolerant grasses, because they promote higher rates of infiltration and permeability.

Deep drains must be provided before this soil can be fully reclaimed. Applying gypsum or sulfur helps to remove harmful alkali, and thereby it increases the intake of water, makes the soil more permeable, and facilitates deep irrigation. Because large amounts of water are needed for leaching away excess salts, overirrigation cannot be avoided during reclamation. Leveling is commonly needed for efficient use of irrigation water. (Capability unit IIIw-356, irrigated)

Ryepatch silty clay loam, drained (Rs).—This soil is similar to Ryepatch silty clay but has a silty clay loam surface layer that is about 9 inches thick. Also, the rate of water intake is higher in this soil, and because artificial drainage is provided through deep drains, the water table is lower. The depth to the water table ranges from 6 to 9 feet.

Use and management.—This soil is used and managed in about the same way as Ryepatch silty clay. However, it is not so clayey as that soil and is well suited to all kinds of row crops grown locally. In addition, less power is required in tilling this soil. If drainage ditches are kept clean, they provide a ready outlet for excess water. (Capability unit IIw-3, irrigated)

Ryepatch silty clay loam (Rp).—This soil is similar to Ryepatch silty clay, but it has a silty clay loam surface layer that is about 9 inches thick. Also the rate of water intake is somewhat higher.

Use and management.—This soil is used and managed in essentially the same way as Ryepatch silty clay. Because the surface layer is not so clayey, this soil is suited to more kinds of crops, and it requires somewhat less power in tillage. (Capability unit IIw-3, irrigated)

Ryepatch silty clay loam, slightly saline-alkali (Rt).—This soil has a thinner, coarser textured surface layer than Ryepatch silty clay, has a more rapid intake of water, and is slightly affected by excess salts and alkali, but in other respects it is similar to that soil. The surface layer is generally 9 inches thick, and the salts and alkali occur in either the surface layer or the subsoil. In some places the alkali in the subsoil causes a reduction in permeability and, in a few places, makes the soil nearly impermeable.

Use and management.—This soil is suited to most irrigated crops grown locally. Because of the salts and alkali, crop yields are only fair. The best yields are obtained from salt- and alkali-tolerant crops.

If this soil is to be fully reclaimed, gypsum or sulfur should be applied to reduce the content of alkali, improve water intake, and increase permeability. Heavy applications of water are needed so that soluble salts can be leached down and out of the root zone. For this reason, irrigation may be less efficient. Deep drains must be provided to dispose of the excess water used in leaching and to avoid a buildup of the water table. (Capability unit IIIw-36, irrigated)

Ryepatch silty clay loam, strongly saline-alkali (Ry).—This soil is similar to Ryepatch silty clay but is strongly affected by salts and alkali and has a silty clay loam surface layer that is about 9 inches thick. It is covered by a dense stand of greasewood and saltbush and an understory of saltgrass, creeping wildrye, and some baltic rush. This vegetation covers 15 to 20 percent of the surface.

Use and management.—Most of this soil is in range that is used for limited grazing. A small acreage is used for irrigated crops, but little has been done to remove the excess salts and alkali from the surface layer, and crop yields have been poor. If the excess salts and alkali are removed, this soil can be managed in about the same way as the soils in capability unit IIIw–36, irrigated. As reclamation continues, yields are likely to improve.

Only the crops most tolerant of salts and alkali should be grown while reclamation is underway. The best suited crops are probably grass and barley, grown in rotation. If water becomes available for additional areas, preparing the soil for irrigation will include land leveling, constructing irrigation ditches, and installing deep drains. The amount of alkali in the soil can be reduced by applying gypsum or sulfur and following this by deep leaching. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Sandy Alluvial Land

Sandy alluvial land consists of recently deposited, poorly drained sand and gravelly sand that washed from soils derived from sedimentary, igneous, and metamorphic rocks. This land type occupies nearly level, frequently flooded areas along the Humboldt River. It is typically very deep, stratified, and calcareous. Because soil material is washed in or washed away by each overflow, the texture of the surface layer changes frequently. At times the land is covered by water for long periods.

The vegetation consists chiefly of baltic rush, bulrush, and water-loving sedges and rushes. Also, willows are common, and rabbitbrush, greasewood, and saltgrass occur in areas that are somewhat better drained. From 70 to 95 percent of the land is bare, depending on the texture of the surface layer and the height of the water table.

Sandy alluvial land is not suited to cultivation, because it is frequently flooded and is difficult to drain. It is best suited to plants that are used for grazing.

Sandy alluvial land (Sa).—This land type occurs in small, low-lying areas scattered along the flood plain of the Humboldt River. It is well stratified and consists mainly of sand and gravelly sand, though finer textured material is common.

Surface runoff is very slow. The permeability, available water capacity, and inherent fertility are variable. Most plants obtain some of their nutrients from ground water. Frequent flooding causes a moderate hazard of erosion.

In most places this land type is a poor source of sand and gravel because it is so highly stratified. In a few places the sand and gravel are excellent, but drainage must be provided before they can be removed. (Capability unit VIw–6, nonirrigated; Wet Saline Bottoms range site)

Sonoma Series

The Sonoma series consists of imperfectly drained, moderately fine textured soils formed in alluvium that washed from many kinds of igneous and sedimentary rocks and from unconsolidated lacustrine sediments. These soils are on smooth, nearly level deltaic flood plains throughout the eastern and western parts of the Lovelock Valley, where they occur with Placeritos, Humboldt, and Ryepatch soils. The vegetation consists of a sparse to dense stand of greasewood, saltbush, and saltgrass. The density of the stand depends on the salt and alkali content of the soil. From 80 to 90 percent of the surface is barren.

These soils are characteristically deep and calcareous. The surface soil is gray and hard and has subangular blocky structure. The subsoil and the substratum are light gray or gray, are hard, and have subangular blocky structure. The soils are saline-alkali in varying degrees.

Where water is available, Sonoma soils are cultivated under irrigation. The principal crops are alfalfa, small grain, pasture grasses, and some corn for silage and other row crops; these crops are generally grown in rotations. The soils affected by salts and alkali are difficult to improve, but after reclamation they produce well.

Sonoma silty clay loam (Sv).—This soil occurs in scattered areas throughout the eastern and western parts of the Humboldt Valley.

Representative profile:

0 to 13 inches, gray silty clay loam, dark gray when moist; subangular blocky structure; hard when dry and firm when moist; strongly calcareous.

13 to 60 inches +, gray to light-gray, stratified silt loam, silty clay loam, and silty clay; gray, very dark gray, or grayish brown when moist; mottled; subangular blocky structure; hard when dry and firm when moist; moderately to strongly calcareous.

The subsoil and the substratum are stratified, but the strata are not in an orderly sequence of thickness or texture. They are generally silty clay loam, though some are silt loam or silty clay. A buried soil commonly occurs at a depth of more than 30 inches, but in places this is lacking to a depth of 5 feet. In some places a few, fine, firm concretions of lime are in the lower part of the substratum, mainly in the buried soil.

This imperfectly drained soil has very slow runoff, moderately slow permeability, and high available water capacity. The soil is highly fertile and has a very deep root zone. It is nonsaline and nonalkali in the surface layer, but below a depth of 36 inches or above the capillary fringe of the water table, it contains slight or moderate concentrations of excess salts and alkali. Generally, the concentrations are slight in areas long under cultivation and are moderate in areas brought under cultivation recently or in areas where the movement of subsurface water is relatively slow. During the peak of the irrigation season, the water table rises to within 4 to 6 feet of the surface. Erosion is not a problem on this soil.

Use and management.—This soil is used for all irrigated crops that are suited to the climate. Alfalfa and small grain, the principal crops, are generally grown in rotation. As a rule, crop yields are good, but they can be increased by using fertilizer. A combination of nitrogen and phosphate generally increases the yield of small grain. The yield and the quality of alfalfa can be improved by applying phosphate every other year. Adding organic matter to the soil through manure or green-manure crops promotes good tilth and increases the intake of water.

Providing adequate drainage is the major problem in the management of this soil. Drainage can be greatly improved by installing both deep and shallow drains and by irrigating the soil carefully. Continued overuse of water is likely to cause a rise in the water table and an accumulation of salts and alkali in the surface layer. (Capability unit IIw–2, irrigated)

Sonoma silt loam, drained (Sn).—This moderately well drained soil is similar to Sonoma silty clay loam but has a thinner, coarser textured surface layer that is about 10 inches thick. In addition, the water table in this soil is kept lower by natural or artificial drainage, and the profile is generally free of excess salts and alkali to a depth of 5 feet. In summer the water table is 6 to 9 feet below the surface.

Use and management.—Except that it does not require improved drainage, this soil is used and managed in about the same way as Sonoma silty clay loam. Artificial drains should be maintained periodically. (Capability unit IIw-2, irrigated)

Sonoma silt loam (Sm).—This soil is similar to Sonoma silty clay loam, but it has a thinner, coarser textured surface layer that is about 10 inches thick. Also, its intake of water is somewhat more rapid.

Use and management.—This soil is used and managed in the same way as Sonoma silty clay loam. Slightly less power is required in tilling this soil. (Capability unit IIw–2, irrigated)

Sonoma silt loam, slightly saline-alkali (So).—The surface layer of this soil is about 10 inches thick. It is thinner and coarser textured than that of Sonoma silty clay loam and is slightly affected by salts and alkali. In general, the concentration of salts and alkali increases with depth, is moderate or strong in the subsoil and the substratum, and is strongest just above the water table.

Use and management.—This soil is used for all irrigated crops that are grown locally. Salt- and alkali-tolerant crops do best. Crops that are sensitive to salts and alkali are not well suited, and their yields are lower. All crops except legumes respond well to addition of a fertilizer that contains nitrogen alone or in combination with phosphate. Applying manure or turning under green-manure crops helps to maintain soil tilth and increases the water intake rate.

The salt and alkali content can be reduced by deep leaching and by applying gypsum or sulfur, provided that deep drains are installed to take care of the excess water used in leaching. Leveling is needed in some fields for proper control and use of irrigation water. Leveling cuts are not restricted.

This soil is difficult to irrigate in some places. Where the substratum has a high content of salts and alkali, deep penetration of water is impossible. In those places, large applications of gypsum are required to reduce the concentration of alkali in the subsoil and substratum, as well as in the surface layer. (Capability unit IIw–6, irrigated)

Sonoma silt loam, drained, strongly saline-alkali (Sr).—This soil is drained by natural drainageways or by the Humboldt River. It resembles Sonoma silty clay loam but has a thinner, coarser textured surface layer that is about 10 inches thick. Also, it contains strong concentrations of salts and alkali. Figure 8 shows a profile of this soil. The water table is at a depth of 6 to 9 feet. Permeability is generally slower in areas under natural vegetation than in cultivated areas. Greasewood and saltbush, the principal plants, cover 10 to 15 percent of the soil surface, depending on the amount of salts in the soil.

Use and Management.—All of this soil is in range that is used for limited grazing.

If irrigation water is made available, reclaiming this soil is feasible but is likely to be difficult. Preparing the soil

Figure 8.—**Profile of Sonoma silt loam, drained, strongly saline-alkali. The surface layer is 12 inches thick.**

for irrigation requires brush removal, leveling, and construction of irrigation ditches. The management needed in reclamation includes deep leaching of soluble salts, installing deep drains to remove the excess water used in leaching, and applying soil amendments to lower the alkali content and to increase soil permeability. The large amount of water used in leaching will probably cause a rise in the water table. While reclamation is underway, only the crops that are most tolerant of salts and alkali should be grown. If this soil is reclaimed and irrigated, it can be managed in about the same way as the soils in capability unit IIw–6, irrigated. (Capability unit VIIs–6, nonirrigated; Alkali Flats range site)

Sonoma silt loam, strongly saline-alkali (Sp).—This soil has a thinner, coarser textured surface layer than Sonoma silty clay loam and is strongly affected by salts and alkali, but in other respects it is similar to that soil. The surface layer is about 10 inches thick. The vegetation is mainly greasewood, saltbush, and saltgrass, and there is some rabbitbrush, alkali sacaton, and baltic rush. These plants cover 15 to 20 percent of the soil surface.

Use and management.—Most areas of this soil are in range, but their forage yield is low. A small acreage has been reclaimed and is used for irrigated crops that are suited to the Area. Crop yields vary according to the extent that excess salts and alkali have been removed from the soil. Some areas have been partly reclaimed and then abandoned.

The irrigated acreage can be enlarged if more water is made available. Among the practices needed are brush removal, leveling, and construction of irrigation ditches. Deep leaching and applying gypsum or sulfur are needed to remove harmful salts and alkali and to avoid a sharp reduction in permeability that commonly follows the leaching of soluble salts from the soil. Deep drains are required to handle excess water. Because the concentrations of salts and alkali are so strong, reclaiming this soil is difficult. While improvement is underway, only salt- and alkali-tolerant crops should be grown. If this soil is reclaimed and irrigated, it can be managed in about the same way as

the soils in capability unit IIw–6, irrigated. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Sonoma silty clay loam, drained (Sw).—This soil is similar to Sonoma silty clay loam but is drained by deep drainage ditches or by the Humboldt River entrenched in its channel. During the peak of the irrigation season, the water table occurs at a depth of 6 to 9 feet. As a rule, leaching prevents an accumulation of excess salts and alkali in the soil.

Use and management.—This soil is used for all irrigated crops grown locally. Crop yields can be increased by using fertilizer. Small grain responds to added nitrogen and phosphate. Turning under crop residue helps to maintain the organic-matter content. Plowing the soil at varying depths is advisable, for it keeps a plowpan from forming. Careful irrigation and periodic maintenance of drains are necessary to prevent salts and excess water from building up in the soil. (Capability unit IIw–2, irrigated)

Sonoma silty clay loam, slightly saline-alkali (Sx).—This soil is similar to Sonoma silty clay loam but is slightly affected by excess salts and alkali and has a somewhat lower rate of water intake. Generally, the accumulation of salts and alkali increases with depth and is strongest in the subsoil or the substratum, just above the water table. In some places the subsoil or the substratum is nearly impermeable because it has such a high content of alkali. Improving the soil in these places is difficult.

Use and management.—All of this soil is used for irrigated crops suited to the Area. Crops are damaged by the alkali in the soil. The damage is negligible during the periods of seed germination and early growth, but when the plants are one-half to three-fourths grown, they abruptly stop growing and produce blossoms and fruit. Crop yields can be increased by adding fertilizer. By turning under crop residue and applying manure, the intake of water is increased and good tilth is maintained.

This soil can be improved by establishing deep drains and by subsequent leaching to remove excess soluble salts. Chemical amendments help to remove the alkali and to increase permeability. Except for the large amount of water applied in leaching, overirrigation should be avoided. (Capability unit IIw–6, irrigated)

Sonoma silty clay loam, strongly saline-alkali (Sy).—This soil contains strong concentrations of salts and alkali, but in other respects it is similar to Sonoma silty clay loam. The vegetation consists mainly of greasewood, saltbush, inkweed, suaeda, and saltgrass. These plants cover 10 to 20 percent of the ground surface, depending on the amount of salts and alkali in the soil.

Use and management.—This soil is used chiefly as range, but a small acreage is cultivated under irrigation. Crop yields are poor.

If water is made available, an additional acreage can be prepared for irrigation, but reclamation is difficult and slow. The reclamation needed consists of leveling, constructing irrigation ditches, installing deep drains, applying soil amendments, and deep leaching. During reclamation, the best crops are those highly tolerant of salts and alkali. If this soil is reclaimed and irrigated, it can be used and managed in about the same way as the soils in capability unit IIw–6, irrigated. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Sonoma silt loam, over clay, slightly saline-alkali (Ss).—This soil occurs in the eastern part of Lower Valley, in the area of transition between Sonoma and Ryepatch soils. It is similar to Sonoma silty clay loam but has a thinner, coarser textured surface layer that is about 6 inches thick, and it is underlain, at a depth of 20 to 36 inches, by a substratum of slowly permeable clay that is similar to the clay in Ryepatch soils. The root zone is moderately deep and is slightly affected by excess salts and alkali.

In some places the clay substratum contains a few, fine and medium concretions of lime. In places, below a depth of 48 inches, it is light gray and olive gray when moist and is generally mottled.

Use and management.—This soil is used for all irrigated crops that are suited to the Area and are tolerant of salts and alkali. The best suited and most productive crop is probably grass, but the yield of any crop generally is only fair.

The management needed to improve this soil consists of providing adequate drainage; applying gypsum or sulfur to reduce the alkali content and increase permeability; and using large amounts of irrigation water so that soluble salts can be leached down and out of the root zone. Owing to the reduced permeability below the subsoil, excess water cannot drain away readily, and deep leaching is likely to cause a temporary perched water table that may injure the roots of alfalfa. For this reason, careful use of irrigation water is essential. Except for deep leaching, the soil should be irrigated in about the same way as a soil having uniformly fine texture. Deep plowing and subsoiling generally do not increase permeability in the clay layers. (Capability unit IIIw–36, irrigated)

Sonoma silt loam, over clay, strongly saline-alkali (St).—This soil contains strong concentrations of salts and alkali, but in other respects it is similar to Sonoma silt loam, over clay, slightly saline-alkali. From 10 to 20 percent of the surface has a cover of vegetation that consists of greasewood, saltbush, suaeda, inkweed, saltgrass, and some rabbitbrush. The density of the plant cover depends on the amount of salts and alkali in the soil.

Use and management.—All the acreage of this soil is in range that is used for grazing.

If water is made available, this soil can be reclaimed, leveled, and irrigated. Until improved, it needs more intensive management than Sonoma silt loam, over clay, slightly saline-alkali, but after improvement the two soils can be used and managed in about the same way. Bringing the soil under irrigation requires irrigation ditches and deep drains. Gypsum or sulfur can be used to help in maintaining the permeability of the soil and to help in removing the alkali. Until the soil is fully reclaimed, only the crops most tolerant of salts and alkali should be grown. (Capability unit VIIw–6, nonirrigated; Alkali Flats range site)

Toulon Series

In the Toulon series are excessively drained, very gravelly, moderately coarse textured soils that formed in sediments deposited as offshore bars in prehistoric Lake Lahontan. The parent material consists of waterworn gravel, sand, and a small amount of silt and was derived

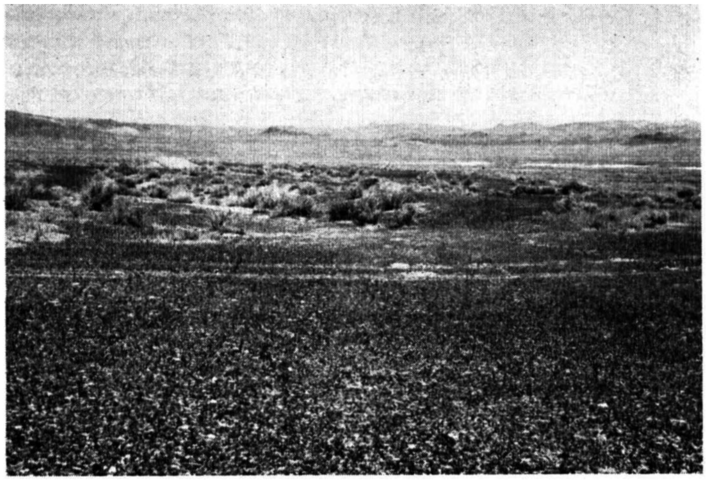

Figure 9.—**Landscape of Toulon very gravelly loam, 0 to 4 percent slopes. Erosion pavement of gravel in foreground.**

from dark-colored chert, quartzite, granodiorite, tufa, and basalt. These soils are mainly on the level tops and partly on the sides of shoreline terraces in the western part of the Lovelock Area. They occur with Mazuma and Bluewing soils.

Toulon soils developed in almost barren areas. The present vegetation consists of only a few plants of bud sagebrush, shadscale, greasewood, and halogeton. More than 99 percent of the surface is bare.

Toulon soils are characteristically very deep and calcareous. They are covered by an almost continuous erosion pavement. The surface layer has platy structure and is white, vesicular, and slightly hard. The subsoil is pale yellow, soft or loose, and massive or single grained. It has many, strong-brown stains of iron oxide. The substratum is gray and pinkish white, loose, and single grained.

Toulon very gravelly loam, 0 to 4 percent slopes (TgB).—This soil on old shoreline terraces occurs in small, scattered areas in the western part of the Lovelock Area. Where the terraces are sloping, they are dissected by small drainage channels.

Representative profile:

0 to 10 inches, white gravelly silt loam in upper part and grayish-brown very gravelly sandy loam in lower part; platy structure; slightly hard to soft when dry and friable or very friable when moist; strongly calcareous.

10 to 20 inches, pale-yellow very gravelly coarse sandy loam with strong-brown stains of iron oxide on the surface and in the fractures of sand grains and pebbles; massive to single grain (structureless); soft or loose when dry and very friable to loose when moist; very strongly calcareous.

20 to 60 inches +, gray and pinkish-white very gravelly and cobbly very coarse sand; single grained (structureless); loose when dry and when moist; slightly calcareous.

The surface is covered by an almost continuous erosion pavement of gravel (fig. 9). The pebbles range from ½ to 4 inches across, are smooth and subrounded or rounded, and have a burnished, dark-brown desert varnish on the upper side. The iron-oxide stains in the subsoil vary slightly in amount. Some of the pebbles in the subsoil and the upper substratum are coated with lime on their lower sides, but in the lower substratum the coating of lime on the pebbles is on both the upper and lower sides. In some places the surface layer and the subsoil contain crystalline gypsum. Cobblestones make up more than 20 percent of the soil in a few places.

This excessively drained soil has very rapid permeability. Surface runoff ranges from very slow to rapid and depends on the slopes and the intensity of rainfall. Roots penetrate very deeply. The available water capacity and the fertility are very low. Erosion is only a slight hazard.

Use and management.—This soil is not suitable for cultivation, and it has little or no value as range because the vegetation is so sparse. However, it is one of the best sources of gravel in the Area. Sand and gravel used for concrete work, for highway construction, and for railroad ballast are taken from deposits in this soil. Some gravel is used for improving farm roads.

In several large pits that have been opened in this and adjacent soils, gravel is exposed to a depth of about 30 feet. The gravel lies in strata, and though the pebbles in each stratum are nearly uniform in size, all sizes of pebbles occur. The strata of gravel are interbedded with strata of coarse sand that are too thin to be of much value as a source of sand. If gravel for concrete is taken from the substratum, the probability of sulfate damaging the concrete is reduced. (Capability unit VIIIs-4, nonirrigated)

Toy Series

The Toy series consists of fine-textured, imperfectly drained-soils that contain excessive salts and alkali. These soils formed in alluvium derived from andesite, basalt, tuff, limestone, and reworked lacustrine deposits. They lie on the smooth, nearly level deltaic flood plain in Lower Valley and occur with Ryepatch and Humboldt soils. The vegetation is a thin stand of greasewood, inkweed, saltgrass, and bassia. More than 90 percent of the soil surface is bare.

Typically, the Toy soils are deep and calcareous. The surface layer is gray and very hard; it has subangular blocky structure. The subsoil is dark gray and very hard; it is prismatic and subangular blocky in structure. The substratum is gray and very hard. It has subangular blocky or angular blocky structure.

Some areas of these soils are now irrigated. Drains have been constructed, and the water table has been lowered to a safe level. The principal crop is tall wheatgrass, but some alfalfa and small grain are grown in rotation. Because the soils have a high content of salts and alkali, crop response is generally poor.

Toy silty clay loam, strongly saline-alkali (Ty).—This soil occurs in Lower Valley, in the east-central part and in other areas scattered throughout.

Representative profile:

0 to 9 inches, gray silty clay loam, black when moist; subangular blocky structure; very hard when dry and firm when moist; very strongly calcareous.

9 to 32 inches, dark-gray clay, black when moist; prismatic breaking to subangular and angular blocky structure; very hard when dry and firm when moist; strongly calcareous.

32 to 54 inches, gray silty clay, dark gray when moist; subangular and angular blocky structure; very hard when dry and firm when moist; moderately calcareous.

54 to 67 inches +, gray clay, very dark gray when moist; subangular blocky structure; very hard when dry and firm when moist; slightly calcareous.

This soil was naturally poorly drained, and it formed under a dense stand of water-loving grasses and other plants that left a moderate amount of organic matter in

Figure 10.—**Profile of Toy silty clay loam, strongly saline-alkali. The surface layer is 9 inches thick and is well flocculated by excess salt. The B2 horizon has columnar structure to a depth of about 32 inches and is underlain by a clayey substratum.**

the surface layer. As drainage improved, the soil became affected by excess salts and alkali (fig. 10), and the original vegetation was replaced mainly by greasewood and saltgrass. Drainage is now imperfect. Surface runoff and permeability are very slow. The water-holding capacity is high, though much of the water is unavailable to plants because of the strong concentrations of salts and alkali. The soil is moderate in fertility and has a deep root zone. Erosion is only a slight hazard.

Use and management.—Most of this soil is cultivated under irrigation or was previously irrigated and then abandoned. Tall wheatgrass, alfalfa, and barley—the principal crops—have produced satisfactory yields in some areas but have not done well in others. The yields depend on the extent of reclamation. The soil contains so much alkali that it crusts on the surface and then cracks as it dries. Except in the cracks, the crust prevents crop seedlings from emerging.

The management needed to replace the alkali in the soil and to flush out soluble salts consists of applying gypsum, sulfur, or other chemical amendments and of using large amounts of water for leaching. Frequent, light irrigations reduce crusting and thereby allow seedlings to emerge. As crops are established, their roots will likely increase permeability and add organic matter to the soil. Deep drains must be installed and maintained to keep the water table from rising and to provide an outlet for leached salts.

Using a large amount of fertilizer that contains nitrogen and phosphorus promotes rapid growth of plants. Applications of manure improve soil tilth and increase the rate of water intake. The residue of the previous crop and of any weeds growing on the soil should be turned under before the next crop is planted. Deep chiseling probably cannot be used to increase permeability and to reduce the salt and alkali content, because the effects of chiseling are counteracted when irrigation water causes the soil to swell.

Only crops that are highly tolerant of salts and alkali are suited to this soil. The best crop is probably grass, but yields are commonly low. Complete reclamation of the soil is unlikely, but some improvement can be made. (Capability unit IVw–36, irrigated)

Toy silty clay, strongly saline-alkali (To).—This soil is similar to Toy silty clay loam, strongly saline-alkali, but has a silty clay surface layer that is about 10 inches thick. Also, the intake of water is somewhat slower.

Use and management.—This soil is used and managed in about the same way as Toy silty clay loam, strongly saline-alkali. Slightly more power is required in farming operations, however, and reclamation is likely to be more difficult because the water intake is slower. (Capability unit IVw–356, irrigated)

Unionville Series

The Unionville series consists of well-drained, moderately coarse textured soils that formed in residuum derived from granodiorite that was influenced by tufa. These soils are on gently rolling foothills in the west-central part of the Lovelock Area and occur with Bluewing and Placeritos soils. The vegetation consists chiefly of upland greasewood and shadscale, but about 96 percent of the soil surface is bare.

These soils are typically shallow or moderately deep over granodiorite bedrock; they are calcareous and high in mica. The surface layer is light gray or light brownish gray, vesicular, slightly hard or hard, and platy in structure. The subsoil is light gray and hard and has subangular blocky structure. The substratum is light gray or light brownish gray, soft or slightly hard, and massive. Underlying the substratum is decomposing granodiorite bedrock.

Unionville very rocky coarse sandy loam, 4 to 8 percent slopes (UnC).—In the Lovelock Area, the only body of this soil occurs in the west-central part. It has many outcrops of rock (fig. 11) and is dissected by many moderately deep channels that were formed by runoff from the outcrops. The vegetation is upland greasewood, shadscale, bud sagebrush, and halogeton, which together cover 2 to 10 percent of the surface.

Representative profile:

0 to 6 inches, light-gray or light brownish-gray coarse sandy loam; platy structure; slightly hard or hard when dry and very friable when moist; very strongly calcareous.

6 to 9 inches, light-gray coarse sandy loam; subangular blocky structure; hard when dry and friable when moist; very strongly calcareous.

9 to 27 inches, light-gray or light brownish-gray coarse sandy loam; massive (structureless); soft or slightly hard when dry and very friable when moist; very strongly calcareous.

27 inches +, decomposing granodiorite bedrock.

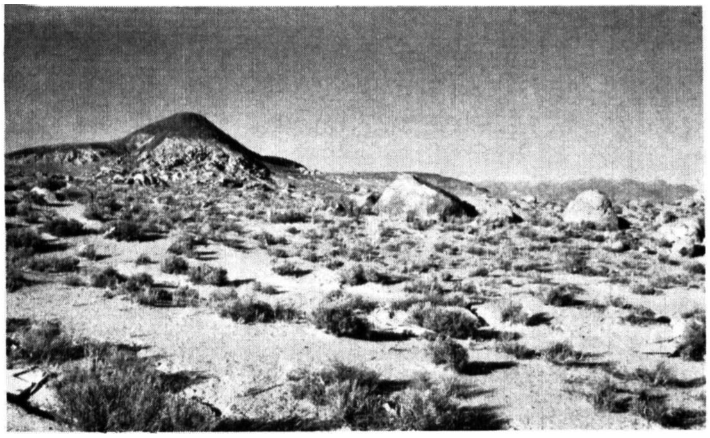

Figure 11.—**Landscape of Unionville very rocky coarse sandy loam, 4 to 8 percent slopes. Outcrops and boulders of granodiorite make up about 30 percent of the surface. The plant cover is shadscale.**

About 30 percent of the surface consists of rock outcrops 8 to 12 feet high and 10 to 15 feet across. Near the outcropping rock, there are many boulders and stones. Some boulders, stones, and outcrops have a deposit of tufa on their exposed surface. The depth to bedrock is generally 15 to 30 inches but is as much as 15 feet in some areas.

The substratum contains lime segregations that vary in amount and occur in a zone 2 to 6 inches thick and 16 to 26 inches below the surface.

This soil is naturally well drained. Surface runoff is slow, permeability is moderately rapid, and the available water capacity is low. The root zone is moderately deep or shallow. The soil has low fertility, is moderately eroded, and is subject to a moderate risk of further erosion.

Use and management.—This soil is in range that is used for limited grazing. It is not suitable as a source of gravel but provides decomposed granite that is used in the beds of roads for farmsteads and feedlots. (Capability unit VIIs–4, nonirrigated; Desert Uplands range site)

Woolsey Series

The Woolsey series consists of soils that are very deep, somewhat gravelly, moderately coarse textured, and somewhat excessively drained. These soils were formed in alluvium that derived from many kinds of igneous and sedimentary rocks and from unconsolidated lacustrine sediments. They occupy smooth, gently sloping or moderately sloping alluvial fans along the southeastern edge of the Lovelock Area, where they occur with Quincy and Lahontan soils. The vegetation is very sparse and is mainly stunted plants of shadscale and greasewood. About 98 percent of the ground is bare.

These soils generally are very deep, low in organic matter, and strongly calcareous. The surface layer is brownish gray, vesicular, soft or slightly hard, and platy in structure. The subsoil is grayish brown, is slightly hard or soft, and has subangular blocky structure or is massive. The substratum is stratified, grayish brown and slightly hard, and it has subangular blocky structure.

Woolsey gravelly fine sandy loam, 2 to 8 percent slopes (WoC).—This soil occurs in several small areas along the southeastern boundary of the survey area. The surface is dissected by small, shallow channels that were cut by water running off higher lying soils.

About 50 percent of the soil surface is covered by a layer of gravel, or an erosion pavement, that consists of pebbles ½ to 1 inch across. From 2 to 6 percent of the surface has a plant cover of shrubs and other vegetation, including greasewood, shadscale, and some bud sagebrush. Small hummocks of windblown material occur at the base of some shrubs.

Representative profile:

0 to 5 inches, light brownish-gray gravelly fine sandy loam; platy structure; soft or slightly hard when dry and very friable when moist; strongly calcareous.

5 to 21 inches, grayish-brown gravelly heavy sandy loam; subangular blocky structure to massive; slightly hard or soft when dry and friable or very friable when moist; moderately calcareous.

21 to 44 inches +, strata of grayish-brown sandy loam and gravelly sandy loam; subangular blocky structure; slightly hard when dry and very friable when moist; moderately or strongly calcareous.

The thickness of the surface layer ranges from 2 to 17 inches; it depends on the amount of erosion or deposition that has taken place. The subsoil contains slightly more clay than the surface layer and is generally about 16 inches thick. In some places, however, it is 18 to 24 inches thick, depending on the gravel content in the lower part.

This somewhat excessively drained soil is low in fertility and has a very deep root zone. Surface runoff is slow. Permeability is moderately rapid. The available water capacity and the erosion hazard are moderate.

Use and management.—All of this soil is in range that is used for limited grazing. It is a poor source of sand and gravel for construction. (Capability unit VIIc–K; Desert Uplands range site)

Use and Management of Soils

In this section are discussed general management practices, saline-alkali soils and their management, capability groups of soils, estimated acre yields of irrigated soils under two levels of management, management of range, engineering applications, and managing soils for wildlife.

General Management Practices

The irrigated soils of the Lovelock Area are used chiefly to produce forage and feed crops for livestock and alfalfa seed and small grain as cash crops. When irrigation water is in normal supply, potatoes, onions, sugar beets, and corn for silage are grown on a small acreage. The water supply and the climate are favorable for enlarging the acreage in cash crops.

Most of the crops produced in the Lovelock Area are sold locally or are fed to livestock. The Area is important in winter as a feeding area for transient herds of beef cattle and sheep that are owned chiefly by stockmen from outside the valley. Some of the crops are shipped to markets out of the State, principally in California. In recent years about one-third of the alfalfa hay grown locally has been sold outside the Area. Four grain elevators operate

in the Area, and two mills grind alfalfa hay into meal for shipment.

Crops

Some of the important irrigated crops grown in the Area and their general management are discussed briefly in the following pages.

Alfalfa.—Alfalfa, the most important crop in the Area, can be grown on all the irrigated soils, except the Toy soils. In 1954, it covered 12,894 acres of cropland, and in 1949, 11,056 acres.

As a rule, alfalfa is planted with a nurse crop of small grain in spring. On a few acres, it is planted alone or in grain stubble late in August or in September. Two or three cuttings are generally made during the season. Most of the alfalfa is cut and baled or is chopped in the field. Some stands are used for grazing in fall rather than for a third cutting. After a field is cut three times, the aftermath can be grazed.

Alfalfa seed was harvested from 605 acres in 1954. The common practice is to cut the first crop of alfalfa for hay and to harvest seed from the second crop.

On almost all soils, alfalfa grows well without added fertilizer but yields can be increased by adding nitrogen and phosphate. Alfalfa responds to phosphate, even though the soils of the Area are strongly calcareous. This crop is commonly fertilized with nitrogen and phosphate after a planting is established and with phosphate during the third year of the stand.

Small grain.—Barley is the principal small grain, but some winter wheat, spring wheat, and oats also are grown. Small grain can be grown on all irrigated soils in the Area except the Toy soils, but it does best in areas that are free of excess salts and alkali. In 1954, there were 3,642 acres of barley in the Area, 1,757 acres of winter wheat, 2,040 acres of spring wheat, and 357 acres of oats.

Barley, spring wheat, and oats are sown from the middle of March to the end of May. These crops are generally irrigated after planting. Ordinarily, they are harvested by combine in August, and then the fields are grazed lightly to clean up the grain left in harvest. Although most straw is baled or burned, turning under as much as possible is better than burning. Winter wheat is sown late in August and then is irrigated.

Much of the barley is fertilized with nitrogen alone or with nitrogen and phosphorus together. Some stands of barley are fertilized by injecting liquid ammonia into the soil before planting or by adding it to the irrigation water.

Permanent pasture.—Permanent pasture produces forage for livestock and is successfully used in reclaiming saline-alkali soils. It can be grown on all irrigated soils in the Area, but the kind of plants differs according to the amount of salts and alkali. A mixture of alfalfa and tall fescue is well suited to all soils except Toy silty clay, strongly saline-alkali. Well suited to that soil is tall wheatgrass alone or in mixture with sweetclover or alfalfa. In the Lovelock Area about 6,000 acres are in permanent pasture.

Pasture is commonly fertilized annually with nitrogen and phosphate combined. In a few places, nitrogen or phosphate applied alone increases the yield of a grass or a legume. Nitrogen is most beneficial in split applications.

Other crops.—Corn for silage, potatoes, and onions can be grown on all irrigated soils that are free of excess salts and alkali. The acreage of these crops generally is small, but it varies from year to year, depending on the water available. For example, corn for silage was grown on 397 acres in 1954 but on only 7 acres in 1949.

Sugar beets can be produced on most irrigated soils of the Area.

Crop rotations

Crop rotations are not rigid in this Area, but generally alfalfa is grown for 6 to 9 years, then small grain for 2 or 3 years. The last crop of small grain is generally a companion crop for a new seeding of alfalfa. On a few fields, 1 year of corn or another row crop is substituted for 1 year of small grain.

Where the supply of irrigation water permits rotation of crops, growing legumes and grasses is a good way to counteract the soil-depleting effects of row crops and small grain. Rotating crops maintains yields and holds tillage to the minimum.

Fertilizer

All the irrigated soils used for crops in this Area respond well to liquid or solid fertilizer, but response is generally better in those soils that are low in nutrients. The specific fertilizer needed depends on the kind of crop grown. Applying a combination fertilizer that contains nitrogen and phosphate increases yields of small grain and aids in establishing alfalfa. Thereafter, alfalfa benefits from phosphate applied every 2 years for the life of the stand. Truck crops should be fertilized annually with a combination fertilizer that is used in two applications, the first applied at planting time and the second applied as topdressing before thinning or before the second irrigation.

Little, if any, potash is required. The soils are believed to be supplied with potassium from mica, which is a mineral bearing potassium, and from the weathering byproducts of volcanic ash.

Barnyard manure adds nitrogen, phosphate, and potassium to the soil and promotes good tilth. It should be applied at the rate of 10 tons or more per acre, at least once during each rotation.

In all the soils of the Area, lime is so abundant that it causes deficiencies of phosphorus and iron. The phosphorus deficiency slows the growth and reduces the yield of most crops, particularly alfalfa. A deficiency of iron causes "lime-induced" chlorosis, or yellowing, in the leaves of trees, shrubs, and a few crops in the Area. Apparently, a deficiency of iron has not reduced the yields of most forage crops in the Area. Chlorosis occurs in alfalfa but never in two successive crops or for two successive years.

Green manure and crop residue

As much organic matter as possible should be added to the soil, except in years when a short supply of irrigation water is forecast. On farms where the major enterprise is growing row crops or small grain, the last crop of hay in each rotation is especially valuable if it is turned under as green manure. On all farms, turning under crop residue improves soil tilth and increases the intake of water. Applying nitrogen fertilizer aids micro-organisms to break down the organic matter in the soil.

If a scanty supply of water is expected, stubble and other crop residue should be left standing to protect the

soil from wind. The residue can be turned under when there is enough water.

Control of insects and weeds

Successful soil management includes suitable measures to control harmful insects and weeds. Among the harmful insects that are or have been in the Area are weevil, pea aphid, yellow-spotted aphid, yellow-striped army worm, timothy mite, red spider, grain aphid, and thrip. These insects can generally be controlled by applying insecticides from the ground or the air, by selecting insect-resistant crops, or by using ladybugs and other natural predators. Specific recommendations for insect control are made annually by the Entomology Research Division and are disseminated through the State Department of Agriculture, the University of Nevada, and the manufacturers of insecticides.

Among the important weeds of the Area are morningglory, whitetop, knapweed, dodder, chicory, puncturevine, wild oats, foxtail barley, and halogeton. An effective program for the control of these weeds requires the use of crop seed that is free of weeds and the proper rotation of crops. In areas that are not in cultivation, applying chemicals is most effective. For the complete control of most perennial weeds, 2 or 3 years are likely to be required.

The improper use of chemicals is costly, results in poor control of weeds, and may discourage a farmer from attempting this type of program again. Professional advice on weed control can be obtained from the county extension agent, the Nevada Department of Agriculture, and other authorities in the field.

Conservation irrigation

The Humboldt River supplies all the water used for irrigation in the Area. Efforts have failed to obtain water of suitable quality by pumping it from underground sources. However, the possibility of obtaining irrigation water by pumping should not be overlooked.

Irrigation water is one of the most valuable resources of the Area, but its greatest benefits depend on its efficient use, which should be based on a careful consideration of soil characteristics and other features of the land. By properly developing a farm irrigation system, water can be controlled and applied on the land according to the principles of conservation irrigation.

A good system for conservation irrigation supplies water in the amount needed for the optimum growth of crops, at the time needed by crops, with as little waste as possible, without erosion. It can mean savings in water and labor, control of erosion, better crop yields, and the continued productivity of soils. In many places, it eliminates the problems of poor drainage and of excess salts and alkali, or it can be a start toward their solution.

Efficient delivery of water to the farms is the first step in supplying the moisture needed by growing crops. A good distribution system is one that has enough capacity to meet the needs of the crops irrigated, that is located and controlled so that seepage losses are negligible, and that carries the required flow safely. The system may be constructed and managed by one farmer or by a group of farmers.

Next, the water must be delivered from the distribution system to the individual fields. An efficient system for transporting water on a farm or a ranch is designed and constructed so that it carries the required flow without undue seepage and without erosion. Control structures are needed to facilitate the handling of water.

The design of an irrigation system is governed by the method of irrigation to be used, the amount of land leveling needed, and the expected efficiency in applying water. In this Area water is generally distributed on a field between borders or in furrows. Sprinkler irrigation is used on only a few acres.

Land leveling is the reshaping of land to a planned grade that permits the uniform application of water without erosion. A field that is properly leveled provides for safely removing excess water from the lower end. The degree of leveling depends on the depth of the soil, the topography, and the method of irrigation to be used.

If water is to be applied efficiently, a farmer needs to know the capacity of the soil to hold water that plants can use (available water capacity), the rate that water enters the soil (intake rate), and the amount of water needed by crops. This knowledge enables him to apply only the amount of water that growing crops require and to keep water losses to the minimum.

As a rule, soils in the Lovelock Area have a high available water capacity. Most soils free of excess salts and alkali hold about 2 inches of available water in each foot of soil. In soils that are saline-alkali, the amount of water held for plants is less than 2 inches because of the salts. Slightly saline-alkali soils hold about 15 percent less available water than nonsaline-nonalkali soils, and strongly saline-alkali soils hold about 50 percent less.

The irrigation water used in the Area has a moderate to high content of soluble salts and sodium. Applying only enough water to meet the needs of crops is advisable most of the time, but an occasional heavy irrigation is necessary to leach accumulated salts from the root zone. Adequate drainage and special irrigation practices for controlling salinity are needed to maintain a favorable salt balance in the soil.

The common practice in the Area is to irrigate alfalfa once for each cutting of hay and to irrigate grain and pasture two or three times in a season. In establishing alfalfa or pasture, a small amount of water is applied several times. Where soils are irrigated in this manner, the water table rises and prevents the complete removal of salts and, except in adequately drained areas, a favorable salt balance.

In this Area border irrigation and furrow irrigation are suitable. Border irrigation consists of applying water to strips of varying width that are separated by low dikes or border ridges. The water advances slowly down the strip and wets the soil. Furrow irrigation consists of applying water down the slope in small trenches 3 to 12 inches deep. The length and the spacing of furrows depend on soil texture and the kind of crop.

Border irrigation is suitable on fields in close-growing crops. It can be effectively used on all soils that can be leveled and have a basic water-intake rate of not more than 3 inches per hour. Furrow irrigation is suitable on fields in row crops. It can be used on all soils except those that have a high intake rate and poor lateral movement of water. Sprinkler irrigation is suitable for nearly all irrigated crops that are commonly grown. Sprinklers are especially helpful in establishing perennial

crops. They are more suitable than are surface methods for irrigating shallow or coarse-textured soils.

The border method is most common in the Lovelock Area. Generally, the length of run ranges from 800 to 1,300 feet. The width of the strip between borders varies from farm to farm and depends on the stream, or head, of water available. On most farms the average stream is 12 to 18 cubic feet per second, but some farmers use considerably more water.

If soils in the Area are to be irrigated efficiently, they must be irrigated rapidly. At one setting, the total stream of water available should be applied to a single border strip rather than to three or four strips. Applying a larger stream decreases the length of time needed to advance the water down the entire strip. As a result, the amount of water applied to the soil is more easily controlled.

Applying water in such a manner requires changes in the farm irrigation system. Permanent headgates are needed to keep ditch banks from washing out, and border ridges must be built higher than those now used.

Drainage

While the soils of the flood plain were forming, their drainage ranged from very poor to excessive. Soon after the first settlers arrived, they began to divert water from the Humboldt River for irrigation, and consequently they altered the natural drainage. The acreage of irrigated land was enlarged rapidly, and by 1890 a large part of the valley was developed. Because water was applied to the soils in larger amounts than could be removed quickly, salts accumulated and crop yields declined.

In 1915, when Drainage District No. 1 was organized in Lower Valley, about 30 miles of open drains were constructed. The lower part of the system was abandoned during the droughts of 1920 and 1930, but after Rye Patch Reservoir was completed in 1936, the natural stream flow increased because of increased precipitation. Water became more plentiful. For the first time, ranchers had irrigation water available late in summer and early in fall.

Throughout the valley these changes brought drainage problems that were partly met when new drains were constructed and existing drains were deepened by the Pershing County Water Conservation District, the U.S. Corps of Engineers, the U.S. Bureau of Reclamation, and private water users. As a result, removing excess water is now less of a problem, but drainage is still inadequate in parts of the valley.

In soils that are inadequately drained, soluble salts and alkali accumulate and retard or prevent the growth of crops. In this Area a significant acreage of cultivated soils is now slightly or strongly saline-alkali. The water available for irrigation contains about 1 ton of soluble salts to each acre-foot of water applied to the soil. The salt content of the water increases or decreases according to the total water available at Rye Patch Reservoir. Unless drainage is provided, using this water for irrigation can make a soil strongly saline-alkali in a short time.

Drainage is a problem in the Lovelock Area because the water table is high throughout the valley and because an excessive amount of water seeps from conveyance ditches and percolates deeply in irrigated fields. The drainage problem is only slightly aggravated by water flowing underground from the surrounding low-lying hills or from the Humboldt River in Upper Valley, where the deeply entrenched river is well below the water table. In Lower Valley, however, the river is not so deeply entrenched, and in the vicinity of Big Five Reservoir, where the river bed is higher than the surrounding land, a substantial amount of water moves from the river and into the soil.

As a rule, the soils in the Area can easily be drained. Although many soils have clay layers, their structure is strong, and they have a high content of lime and of organic matter. Consequently, they are sufficiently permeable for water to move at a rate that insures adequate drainage. In addition, many soils are dissected by old channels filled with sandy material. These channels can be used as aquifers to help improve drainage. Deep drains should be located so that they intercept these channels, and irrigation ditches that cross them should be lined.

Studies made by the U.S. Bureau of Reclamation indicate that the long-range trend and the seasonal fluctuations of the water table are closely related to irrigation. The general flow of subsurface water is down the valley, and the slope of the water table conforms closely to the slope of the ground. The water table is low in winter and reaches its greatest depth in March. After the start of irrigation in March, it rises rapidly and is nearest the surface late in June or early in July, when irrigation is heaviest. In August and September, as irrigation declines, the ground water recedes slowly, but near the close of the season, generally in September, the fall is more rapid. Between the end of October and the close of winter, the water table falls slowly to its greatest depth. Seasonally, the water table fluctuates 2 to 10 feet, and during the irrigation season, it rises and falls as much as 3 feet in a week and 6 feet in a month.

Seepage losses are most excessive in the Young and the Old Channel Canals in Upper Valley. For about 2¼ miles, these canals are parallel, are higher than the surrounding land, and cross several old channels filled with sand. Studies by the Bureau of Reclamation indicate that the canals contribute substantially to the ground water of the Area.

Other piezometer studies show that the effectiveness of existing drains depends primarily on the depth of the drain, the permeability of the soil, and the occurrence of aquifers. The studies indicate that an open drain, 12 feet deep, lowers the water table on each side for a distance of ¼ to more than ½ mile.

Upper Valley includes about 13,600 acres of irrigable land and has two main drains, the Graveyard Drain on the west side, and the Lovelock Drain on the east side. These join to form the Toulon Drain, which empties into Toulon Lake and supplies its water. The Toulon Drain crosses wasteland throughout its length and functions only as an outlet for excess water.

Part of Upper Valley is reasonably well drained. A large area, however, is inadequately drained because the existing drains are too shallow, the lateral drains are too few, and seepage is excessive from the Old Channel and the Young Channel Canals. In addition, dams hold water at a high level in the Graveyard, Lovelock, and Johnson Drains, and the Pitt Diversion Dam holds the water high in the Humboldt River.

Figure 12.—**A pumping station on a north-south lateral of the Keys Drain. Drainage water is lifted about 10 feet and then discharged by gravity flow into Humboldt Lake.**

Lower Valley contains about 27,000 acres of irrigable soils and is served by two main drains, the Army Drain and the Keys Drain. Water is discharged into the Army Drain from one east-west lateral and several north-south laterals. Except in the most northern part, many short drains empty into the north-south laterals.

Most parts of Lower Valley are adequately drained, but new laterals are needed at the northern end, where drains are lacking. In years when runoff is normal, drainage water flows by gravity to Humboldt Lake, but if the lake rises because of abnormally high runoff, pumps must be installed to lift drainage water over the flood-control dike.

In the area below the Army Drain, excess water is removed by the Keys Drain and its east-west and north-south laterals. This area is effectively drained, but excess water is pumped into Humboldt Lake because a ditch deep enough for drainage does not provide gravity flow (fig. 12).

Saline-Alkali Soils

Most soils in arid regions contain soluble salts, and in places the salts are highly concentrated. Soluble salts are among the products of the weathered primary soil minerals. In humid regions, percolating rainfall generally leaches salts out of the soil, but in arid regions, where rainfall is low and evaporation and transpiration are high, leaching is incomplete and some of the salts remain.

Weathered primary minerals directly or indirectly supply nearly all soluble salts, but in only a few places do enough salts accumulate in place from the primary minerals to form a saline soil. Saline soils have generally received salts from other locations, and the main carrier is water.

In the Lovelock Area, salts accumulate through the action of surface water and ground water. Many of the soils are affected by salt because they are irrigated with water that contains dissolved salts. Flooding streams carry salts from outside the Area and deposit them in low-lying places. Where saline ground water rises close to the surface, it evaporates and leaves salts.

Saline soils contain excessive amounts of soluble salts only, whereas alkali soils contain excessive adsorbed sodium. Soils that contain both excess soluble salts and alkali are described as saline-alkali. As long as their salt content remains excessive, saline-alkali soils resemble saline soils in appearance and in properties. Under conditions of excess salts, pH readings are seldom above 8.5, and the soil particles remain flocculated. If the excess salts are leached out, however, a saline-alkali soil generally becomes nonsaline-alkali, and its physical properties change markedly. As leaching reduces the concentration of salts in the soil solution, some of the exchangeable sodium hydrolyzes and forms sodium hydroxide. Then the soil may become strongly alkaline and have pH readings above 8.5. Soil particles disperse, tilth is poor, and water does not enter or move through the soil well.

Saline-alkali phases of several of the soils have been mapped. The degree to which a soil is affected by excess salts and alkali is determined by examining the vegetation, by observing the characteristics of the soils, and by making laboratory analyses of soil samples collected in the field. As a result, three saline and alkali classes are defined in the Lovelock Area. These classes are based primarily on the amount of salts and alkali contained in the surface layer of the soil at the time of the survey. Two of the three classes are identified on the soil map as soil phases. The three classes are—

1. *Soils free of excess salts and alkali* contain less than 0.15 percent of salts. The conductivity of the saturation extract is less than 4 millimhos per centimeter at 25° C., and the percentage of exchangeable sodium is less than 12.
2. *Slightly saline-alkali soils* contain 0.15 to 0.35 percent of salts, or the conductivity of the saturation extract is 4 to 8 millimhos per centimeter at 25° C. The percentage of exchangeable sodium is 12 to 40 for coarse textured and moderately coarse textured soils and is 12 to 25 for medium-textured to fine-textured soils.
3. *Strongly saline-alkali soils* contain more than 0.65 percent of salts, or the conductivity of the saturation extract is greater than 15 millimhos per centimeter at 25° C. The percentage of exchangeable sodium is greater than 40 for coarse textured and moderately coarse textured soils and is greater than 25 for medium-textured to fine-textured soils.

Although a distinct gap occurs between the second class and the third, an intermediate, or moderate, class is not needed, because less than 1.0 percent of the samples analyzed was moderately saline-alkali.

Some soils mapped as slightly saline-alkali are free of excess salts and alkali in the uppermost 4 or 5 inches, but they contain slight or moderate concentrations just below the plow layer. Several soils mapped as strongly saline-alkali are only slightly affected in the plow layer, but they contain strong concentrations just below the plow layer.

Several soils in the Lovelock series are classed as saline but not alkali, though their percentage of exchangeable sodium is greater than 15. The sodium does not adversely affect these soils when they are improved by removing the soluble salts. In Lovelock soils unfavorable effects of sodium are probably inhibited by the high content of organic matter, diatomaceous earth, and volcanic glass.

Managing saline-alkali soils

Soils differ in the kinds of salts they contain and in the practices they need for improvement. For this reason, each soil may require individual treatment. In dealing with the problem, however, some general guidelines can be given that should be helpful.

Reclaiming the Lovelock soils is possible wherever adequate drainage can be provided and enough water is available to leach away the excess salts. Areas that have an uneven surface must be leveled to provide a uniform grade for irrigation. Flooding between high border dikes is the most suitable method of applying water. After the soil has been irrigated, it should be seeded to a salt-tolerant grass or to barley. A normal irrigation schedule can be followed, but a large amount of water should be applied during each irrigation so that soluble salts are flushed out of the soil and into the drainage water. Leaching should be continued until the soil is free of excess salts.

If the foregoing practices are followed, a partial crop likely can be harvested at the end of the first irrigation season. Normal allocations of irrigation water probably will remove all of the harmful salts from the surface layer in a short time. After the salinity has been lowered to a safe level, the soil is suited to more kinds of crops, and the cropping system can then be changed. Crop suitability can be determined by analyzing soil samples at the end of an irrigation season.

Improving soils that contain an excessive amount of adsorbed sodium, or alkali, is more difficult and may require more time. Among these soils are the Humboldt, Placeritos, Ryepatch, and Sonoma soils. In addition to draining, leaching, and the other practices needed for the improvement of saline soils, a chemical amendment must be added to saline-alkali soils to replace the adsorbed sodium.

Chemical amendments for replacing sodium are gypsum and its various forms, including gypsite, anhydrite, and selenite, as well as elemental sulfur, sulfuric acid, iron sulfate, and aluminum sulfate. Any of these amendments can be successfully used, though some are faster to react than others. Cost and availability generally determine the choice. The amount of amendment needed for improving a soil is determined by an analysis of soil samples that indicates the amount of sodium that must be replaced if the soil is to be improved.

If an amendment other than gypsum or sulfur is desired for use, the relative amount needed can be determined from the following comparison: One ton of sulfur is equivalent to 3.06 tons of sulfuric acid, 5.38 tons of gypsum ($CaSO_4 \cdot 2H_2O$), 8.69 tons of iron sulfate ($FeSO_4 \cdot 7H_2O$), and 6.94 tons of aluminum sulfate ($Al_2SO_4 \cdot 3 \cdot 18H_2O$).

Iron sulfate and aluminum sulfate act quickly, but high cost prohibits their general use. In the Lovelock Area, the choice of amendment is limited to gypsum or sulfur.

From the standpoint of efficiency in replacing sodium, it is advantageous to leach most of the soluble salts before applying chemical amendments. If the soluble salts are removed first, more of the calcium supplied by the amendments is available for replacing adsorbed sodium. From the standpoint of soil improvement, however, the efficient removal of sodium by leaching before amendments are applied may be more than offset by the decrease in soil permeability that generally accompanies the leaching of salts from saline-alkali soils. Resulting permeability determines, therefore, whether amendments should be applied before or after soluble salts are removed. In the Lovelock Area, it is advisable to remove part of the salts through leaching and then to apply the amendment.

Chemical amendments normally are broadcast and incorporated into the soil by light disking. Sulfur should be thoroughly mixed with the soil to insure rapid oxidation to the sulfate form. Amendments can be applied by adding them to irrigation water, but this method is poorly suited to the Lovelock Area. Gypsum dissolves so slowly that the amount that can be applied in irrigation water is less than the amount needed by the soil. Consequently, improving a soil by using gypsum in this way is likely to take several years.

Except where sulfur is used, saline-alkali soils should be leached immediately after the amendment is applied. Leaching dissolves the amendment and carries it downward, and it also removes the soluble sodium salts that form as the adsorbed sodium is replaced by calcium.

Where sulfur is applied, sufficient time should be allowed before leaching so that the amendment oxidizes and reacts with the lime to form gypsum. The soil must be kept moist, however, because water is needed for the oxidation of sulfur. Consequently, the most desirable season for applying sulfur is fall rather than spring.

By analyzing soil samples, the amount of amendments needed to improve saline-alkali soils can be determined. Since the amount of soluble salts and alkali may vary within short distances, the sampling shows only the average concentrations in a field. If some alkali spots are left after the first treatment, these can be corrected the following year. An estimate of the amount of amendments needed should not be based on an analysis of the spots most strongly alkali, because the estimate would be two to five times greater than the amount actually needed.

If soil tests show that the amount of gypsum required is too expensive, a soil can be considerably improved by growing salt- and alkali-tolerant grasses. Among the grasses well suited are tall wheatgrass, western wheatgrass, and tall fescue.

In using grass to improve an area, the most serious problem is getting a stand. High concentrations of salts delay germination by limiting the absorption of water, and seeds may not germinate after the first irrigation, or even after the second or third. Seeds that fail to germinate eventually rot.

The second stage in establishing grass is the growth of seedlings upward through the soil. If a saline-alkali soil dries out, it tends to bake and to crust. When the surface

TABLE 2.—*Chemical analyses of water samples from four locations on the Humboldt River*

Years sampled	Sampling location	Sodium content (percentage of bases)	$EC \times 10^6$ at 25° C	B	Ca	Mg	Na	CO_3	HCO_3	Cl	SO_4
		Percent		*EPM*[1]	*EPM*[1]	*EPM*[1]	*EPM*[1]	*EPM*[1]	*EPM*[1]	*EPM*[1]	*EPM*[1]
1942–1949	Palisade gaging station: (About 135 miles upstream from Rye Patch Reservoir)	34	482	0. 17	2. 25	1. 09	1. 76	0. 49	3. 54	0. 52	0. 71
1942–1945	Comus gaging station: (About 60 miles upstream from Rye Patch Reservoir)	48	609	0. 33	2. 03	1. 16	2. 97	0. 58	4. 13	0. 87	1. 13
1942–1949	Callahan Bridge gaging station: (At upper end of Rye Patch Reservoir)	48	683	0. 30	2. 38	1. 24	3. 45	0. 50	4. 41	1. 24	1. 31
1942–1949	Rye Patch Dam.	63	1, 037	0. 53	2. 10	1. 57	6. 52	0. 89	4. 29	3. 68	1. 86

[1] Equivalent per million: A unit chemical equivalent weight of an ion per million unit weights of solution. Equivalents per million and milliequivalents per liter (meq./l.) are numerically identical if the specific gravity of the solution is 1.0.

is seriously encrusted, seedlings cannot break through and they die.

Frequent, light irrigations can be used to reduce the salt accumulation around the seeds and to prevent crusting. The soil may need irrigating every 3 to 5 days until the crop has grown to a height of 3 to 5 inches. Applying a small amount of gypsum or sulfur—generally 2 to 4 tons per acre—helps to prevent crusting and thereby allows seedlings to emerge.

Crops should be selected that will produce satisfactory yields in saline-alkali soils (*10*).[1]

Quality of irrigation water

The quality of water in the Humboldt River varies greatly from the upper watershed above Palisade to the Lovelock Valley. Salts are progressively concentrated in the downstream part of the river as water evaporates from the stream channel and the flood plain and as saline water drains back to the river from irrigated areas. The increase in salinity of river water is shown in table 2, which gives data obtained by analyses of samples taken at Palisade, Comus, Callahan Bridge, and Rye Patch Dam.

Throughout its course the Humboldt River contains a fairly high percentage of sodium. In the upper parts of the stream, where the water supply is abundant and the total content of mineral matter is low, the sodium is of little concern. At the lower end of the river, however, the sodium content is significant because water is in limited supply and contains a fairly large amount of dissolved salts. Drainage water adds a large amount of salts to the river between Palisade and Rye Patch Reservoir. At the entrance to Rye Patch Reservoir in 1949, the average salt content of river water was 0.54 ton of salt to the acre-foot of water. In comparison the water released from the reservoir averaged 0.80 ton of salt to the acre-foot of water, an increase of about 48 percent. The increase likely was caused by evaporation and other factors. Table 3 gives data obtained by analyses of irrigation water sampled at Rye Patch Dam for the years 1943 through 1949. Although table 3 does not show the relationship between quality of water and volume of flow, the quality was better in seasons of high flow than in seasons of low flow.

[1] Italicized numbers in parentheses refer to Literature Cited, p. 87.

TABLE 3.—*Chemical analyses of irrigation water at Rye Patch Dam*

[Data are average for the irrigation season]

Year	Number of samples	$EC \times 10^6$	Reaction	Total dissolved solids	Salt content per acre-foot of water	Boron	Soluble sodium (percentage of bases)	Equivalents per million grams					
								Ca	Mg	Na	CO_3 and HCO_3	SO_4	Cl
			pH	*PPM*[1]	*Tons*	*PPM*[1]	*Percent*						
1943	18	955	--------	680	0. 988	0. 44	57. 8	2. 35	1. 49	5. 26	5. 30	1. 71	2. 48
1944	16	941	--------	702	0. 962	0. 52	60. 5	2. 10	1. 57	5. 65	5. 43	1. 73	2. 68
1945	23	998	--------	735	0. 996	0. 54	61. 8	2. 25	1. 49	6. 27	5. 48	1. 75	3. 10
1946	16	822	--------	625	0. 905	0. 44	54. 7	2. 20	1. 49	4. 61	5. 15	1. 50	2. 03
1947	17	1, 128	--------	788	1. 021	0. 59	67. 7	1. 95	1. 61	7. 30	5. 22	1. 87	4. 35
1948	15	1, 284	--------	830	1. 092	0. 69	69. 8	1. 80	1. 90	9. 00	5. 38	2. 31	5. 87
1949	10	823	8. 2	536	0. 800	0. 43	59. 0	1. 72	1. 40	5. 12	4. 40	1. 64	2. 53
Average	16	992	--------	698	0. 97	0. 52	61. 5	2. 05	1. 56	6. 20	5. 20	1. 78	3. 28

[1] Parts per million.

TABLE 4.—*Chemical analyses of irrigation water at five diversion dams*

[Average values for the years 1948 and 1949]

Diversion dam	EC×10⁶	Total dissolved solids	Salt content per acre-foot of water [1]	Boron	Soluble sodium (percentage of bases)	Equivalents per million grams						
						Ca	Mg	Na	CO_3	HCO_3	SO_4	Cl
		PPM [2]	*Tons*	*PPM* [2]	*Percent*							
Young	999	606	0. 86	0. 33	65. 0	1. 66	1. 01	7. 20	0. 27	4. 57	1. 89	3. 62
Pitt	995	612	0. 93	0. 37	64. 1	1. 55	1. 44	6. 78	0. 29	4. 47	1. 90	3. 66
Irish American	982	607	0. 95	0. 40	66. 3	1. 44	1. 43	6. 26	0. 38	4. 07	1. 89	3. 58
Rogers	1, 040	636	1. 04	0. 44	64. 2	1. 44	1. 38	6. 98	0. 35	4. 33	1. 98	4. 12
Big Five	1, 367	814	1. 38	0. 76	76. 8	1. 46	1. 42	10. 29	0. 30	4. 61	2. 36	6. 37

[1] Averages from field tests based on electrical conductivity on 13 to 19 samples.
[2] Parts per million.

Studies by the U.S. Bureau of Reclamation indicate that the salt content of irrigation water increases only a little between Rye Patch Dam and Young Dam, the first diversion dam downstream from Rye Patch. Below Young Dam, the increase is gradual and occurs mostly downstream from the Irish-American Dam, the lowest dam used for diverting water to Upper Valley. The increase in salinity below the Irish-American Dam is caused by the large amount of saline water that seeps back to the river from irrigated areas.

During the irrigation seasons of 1948 and 1949, samples of water were analyzed by the Bureau of Reclamation to determine the amount of change in salt content of the river downstream from Rye Patch Reservoir. Compared to the amount of salts contained in water at Rye Patch Dam, the concentration of salts at each of the diversion dams showed the following average increase: Young Dam, none; Pitt Dam, 3 percent; Irish-American Dam, 5 percent; Rogers Dam, 15 percent; and Big Five Dam, 53 percent. Table 4 gives data obtained by analyzing samples of water taken at these five points of diversion in 1948 and 1949.

Except for water in the Lovelock Drain, drainage water in the Area is generally too saline for irrigation. In 1948 and 1949, drainage water sampled at five stations had a content of salts ranging from 1.6 to 10.5 tons of salts to the acre-foot of water. In general the concentration of salts decreases during the irrigation season, when the drainage flow is high. The concentration is lowest near the close of the irrigation season and is highest in spring, just before the start of the season. Drainage water discharged from Upper Valley contains less salt than that from Lower Valley, where 6,000 acres or more have been brought under irrigation in recent years. Table 5 gives chemical analyses of drainage water for the years 1948 and 1949.

TABLE 5.—*Chemical analyses of drainage water*

[Data are average for the year]

Drain	Sampling station	Year	EC×10⁶	Total dissolved salts	Salt content per acre-foot of water	Boron	Soluble sodium (percentage of bases)	Equivalents per million grams					
								Ca	Mg	Na	HCO_3	SO_4	Cl
				PPM [1]	*Tons*	*PPM* [1]	*Percent*						
Graveyard	Pitt (drainage water from upper one-fourth of Upper Valley).	1948	3, 486	2, 192	2. 98	1. 86	72. 5	5. 27	4. 05	23. 74	7. 93	8. 72	20. 05
		1949	3, 270	2, 078	2. 83	2. 35	75. 0	2. 75	4. 58	25. 26	3. 95	8. 82	19. 60
Lovelock	B and B (drainage water from area near and north of Lovelock).	1948	2, 384	1, 478	2. 01	1. 59	59. 0	5. 99	2. 90	12. 80	5. 18	4. 73	14. 35
		1949	2, 218	1, 413	1. 94	1. 19	58. 2	3. 92	2. 51	12. 95	2. 56	5. 10	14. 17
Toulon	Perth (drainage water from Upper Valley).	1948	3, 339	2, 092	2. 85	1. 74	69. 2	5. 79	3. 83	21. 65	7. 14	8. 07	20. 19
		1949	2, 985	1, 908	2. 59	1. 93	68. 5	3. 11	3. 50	21. 14	4. 12	7. 52	18. 78
Army	Big Five (drainage water from areas newly irrigated).	1948	8, 635	5, 516	7. 50	2. 32	67. 3	17. 01	10. 86	57. 33	2. 39	9. 66	77. 06
		1949	6, 677	4, 523	6. 15	2. 70	63. 9	11. 79	8. 03	44. 64	2. 41	8. 91	58. 51
Army	Airport (drainage water from Lower Valley).	1948	7, 109	4, 639	6. 31	2. 23	64. 7	16. 04	8. 56	45. 04	3. 85	9. 65	61. 11
		1949	6, 577	4, 474	6. 08	2. 44	60. 8	14. 41	8. 41	42. 07	3. 44	9. 65	56. 06
Average				3, 030	4. 12	2. 03	65. 9	8. 61	5. 72	30. 66	4. 30	8. 08	35. 99

[1] Parts per million.

The ground water under the flood plain of the Humboldt River contains a large amount of dissolved solids and is high in percentage of sodium. It is generally unfit for use in irrigation and by livestock.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable the soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. Eight capability classes are in the broadest grouping and are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIw. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, which are groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. In the Lovelock Area, capability units are given numbers or letters that either explain briefly the chief limitation responsible for placement of the soils in the capability class and subclass or that suggest other limitations within the unit in addition to the major limitation indicated by the small letter *w*, *s*, or *c*. For this reason, units in each subclass are not numbered consecutively, and their symbols are a key to some of the problems or limitations that affect the soils. The numbers and letters used to designate units are—

A. Few or no limitations.
2. Wetness because of a high water table.
3. Slow permeability in the subsoil.
4. Droughty soils underlain by rapidly permeable sand.
5. Clayey soils.
6. Excess salts or salts and alkali.
0. Loamy soils susceptible to wind erosion.
L. Sandy soils.
K. Rainfall insufficient for reseeding perennial grass.

Capability units with more than one limitation are designated by more than one digit. For example, in capability unit IIw-35 are clayey soils (5) that have slow permeability in the subsoil (3).

Soils are classified in capability classes, subclasses and units according to the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this Area, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use. (No subclasses)
- Capability unit I-A.—Very deep, loamy, nearly level soil that is well drained.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIw. Soils that have moderate limitations because of excess water.
  - Capability unit IIw-2.—Loamy, very deep, nearly level soils.
  - Capability unit IIw-3.—Loamy, very deep, nearly level soils that have reduced permeability in the subsoil and the substratum.
  - Capability unit IIw-35.—Clayey, very deep, nearly level soils that have reduced permeability in the subsoil and the substratum.
  - Capability unit IIw-5.—Clayey, very deep, nearly level soils.
  - Capability unit IIw-6.—Loamy, very deep, nearly level soils that are slightly saline-alkali.
  - Capability unit IIw-0.—Loamy, very deep, nearly level soil that is highly susceptible to wind erosion.
  - Capability unit IIw-03.—Loamy, very deep, nearly level soils that have a slowly permeable substratum and are highly susceptible to wind erosion.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIw. Soils that have severe limitations because of excess water.
  - Capability unit IIIw-356.—Clayey, nearly level, slightly saline-alkali soils that have reduced permeability in the subsoil and the substratum.
  - Capability unit IIIw-36.—Loamy, nearly level, slightly saline-alkali soils that have reduced permeability in the subsoil and the substratum.
  - Capability unit IIIw-4.—Loamy, nearly level, droughty soil that is underlain by sand.
  - Capability unit IIIw-46.—Loamy, nearly level, droughty soil that is underlain by sand and is slightly saline-alkali.

Capability unit IIIw-56.—Clayey, nearly level, slightly saline-alkali soil.

Capability unit IIIw-036.—Loamy, nearly level, slightly saline soil that has a slowly permeable subsoil and is highly susceptible to wind erosion.

Capability unit IIIw-06.—Poorly drained, nearly level, loamy soil that is slightly saline and is highly susceptible to wind erosion.

Subclass IIIs. Soils that have severe limitations of moisture capacity or tilth.

Capability unit IIIs-L.—Sandy, very deep, nearly level soil that is droughty.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVw. Soils that have very severe limitations for cultivation, because of excess water.

Capability unit IVw-356.—Clayey, nearly level, strongly saline-alkali soil that has a slowly permeable subsoil and substratum.

Capability unit IVw-36.—Loamy, nearly level, strongly saline-alkali soil that has a slowly permeable subsoil and substratum.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover. No soils in the Lovelock Area are in class V.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIw. Soils severely limited by excess water and generally unsuitable for cultivation.

Capability unit VIw-6.—Poorly drained, nearly level, loamy soils that are strongly saline or strongly saline-alkali.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIw. Soils very severely limited by excess water.

Capability unit VIIw-6.—Strongly saline-alkali soils that are imperfectly drained.

Subclass VIIs. Soils very severely limited by moisture capacity, stones, or other soil features.

Capability unit VIIs-4.—Coarse textured and moderately coarse textured, nearly level to strongly sloping soils that are well drained to excessively drained.

Capability unit VIIs-6.—Strongly saline-alkali soils that are well drained or moderately well drained.

Capability unit VIIs-L.—Deep, excessively drained sand.

Subclass VIIc. Soils too severely limited by lack of moisture to support crops.

Capability unit VIIc-K.—Deep, nearly level to moderately sloping, medium-textured and moderately coarse textured soils that have a moderate or high available water capacity.

Class VIII. Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants; and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

Subclass VIIIs. Soils that produce little or no vegetation because of unfavorable texture.

Capability unit VIIIs-4.—Droughty, very gravelly soil that overlies stratified sand and gravel at a depth of less than 10 inches.

Management by capability units

In the following subsection, each of the capability units in the Lovelock Area is described and the soils in it are listed. Suggestions are given on how to use and manage the soils in each unit.

For the capability units in classes I through IV, table 6 lists the suitable crops and suggests crop rotations based on these crops as major enterprises: alfalfa, small grain or row crop, and hay or pasture.

TABLE 6.—*Suitable crops and suggested crop rotations according to capability units*

Capability units	Suitable crops	Suggested crop rotations
I-A, IIw-2, IIw-3, IIw-35, IIw-5, and IIIw-4.	Corn for silage, sugar beets, potatoes, garlic, onions; barley, wheat, oats; alfalfa, tall fescue, and other grasses and legumes for seed, hay, or pasture.	(a) Major enterprise alfalfa: 5 or 6 years of alfalfa, 1 year of small grain or row crop. (b) Major enterprise small grain or row crop: 5 years of alfalfa, 3 years of small grain or row crop. (c) Major enterprise hay or pasture: 6 to 8 years of alfalfa-grass, 2 years of small grain or row crop.
IIw-0, IIw-03, and IIIs-L	Corn for silage, sugar beets, potatoes, garlic, onions; barley, wheat, oats; alfalfa, tall fescue, and other grasses and legumes for seed, hay, or pasture.	(a) Major enterprise alfalfa: 4 or 5 years of alfalfa, 1 year of small grain or row crop. (b) Major enterprise small grain or row crop: 4 or 5 years of alfalfa, 3 years of small grain or row crop. (c) Major enterprise hay or pasture: 5 to 7 years of alfalfa-grass, 2 years of small grain or row crop.
IIw-6, IIIw-356, IIIw-36, IIIw-46, IIIw-56, IIIw-036, and IIIw-06.	Sugar beets; barley; alfalfa, tall fescue, and other grasses and legumes tolerant of salts and alkali.	(a) Major enterprise alfalfa: 4 or 5 years of alfalfa, 1 year of small grain or row crop. (b) Major enterprise small grain or row crop: 4 or 5 years of alfalfa, 3 years of small grain or row crop. (c) Major enterprise hay or pasture: 5 to 7 years of alfalfa-grass, 2 years of small grain or row crop.
IVw-356 and IVw-36	Barley; tall wheatgrass, sweetclover, alfalfa	8 to 10 years of tall wheatgrass and sweetclover, 2 years of barley.

Additional information about the management of each soil is given in the section "Descriptions of Soils."

CAPABILITY UNIT I-A

Placeritos loam, drained, is the only soil in this capability unit. It is a light-colored, friable soil that is more than 60 inches deep, has a moderately permeable subsoil and substratum, and is well drained. Slopes range from 0 to 2 percent. The soil is fertile, is easy to work, and has a high available water capacity. Productivity is high. Excess salts and alkali are not a problem.

All crops suited to the climate do well on this soil. Row crops, small grain, and alfalfa are best suited and are generally grown in rotation. The alfalfa is planted alone or in mixture with grass. The kind and the sequence of crops in the rotation are partly determined by the amount of irrigation water available.

Applying fertilizer to this soil increases the yield of all crops. The number of tillage operations should be kept to the minimum, because excess tillage tends to impair tilth and to reduce the intake of water.

Leveling is needed in some fields for efficient irrigation. Water can be effectively applied to row crops from furrows and to other crops by border flooding. The length of run can be moderate or long, depending on the flow, or head, of water available and the width of strips between borders. Although a high water table does not occur in this soil, care in irrigation is necessary. Using too much water raises the water table in soils that lie at lower levels and may cause an accumulation of salts and alkali in those soils.

CAPABILITY UNIT IIw-2

In this capability unit are light-colored and dark-colored loams, silt loams, and silty clay loams that are more than 60 inches deep and are imperfectly drained. These soils occupy the flood plain on slopes of 0 to 2 percent. They are fertile, easy to work, and highly productive, and they have a high available water capacity. Permeability is moderate or moderately slow in the subsoil and is moderately slow to moderately rapid in the substratum. The soils are—

Humboldt silt loam.
Humboldt silt loam, drained.
Humboldt silt loam, moderately coarse substratum.
Placeritos loam.
Sonoma silt loam.
Sonoma silt loam, drained.
Sonoma silty clay loam.
Sonoma silty clay loam, drained.

All crops suited to the climate do well on these soils. Best suited are row crops, small grain, and alfalfa or alfalfa-grass mixtures grown in rotation. The choice of crops and the specific rotation used are partly determined by the amount of irrigation water available. Crops respond well to fertilizer. Excessive tillage should be avoided because it breaks down the structure of the soils, impairs tilth, and reduces the intake of water.

Artificial drainage is needed for removing excess water from these soils. Unless the soils are drained, the water table will rise during the irrigation season into the root zone of alfalfa and other deep-rooted crops. As a result, harmful salts and alkali will accumulate in the soils above the water table and cause a reduction in crop yields.

Leveling is commonly needed to prepare these soils for efficient irrigation. Suitable methods of irrigating are furrows for row crops and border flooding for other crops. Runs can be moderate or long, depending on the head of water available and the distance between borders. Care in irrigating is essential to avoid raising the water table.

CAPABILITY UNIT IIw-3

The soils in this unit occupy slopes of 0 to 2 percent on the flood plain. They are dark-colored, friable silt loams and silty clay loams that are more than 60 inches deep and are moderately well drained or imperfectly drained. Some are underlain by a clay layer that reduces permeability. These soils are fertile, highly productive, and easy to work. They have a high available water capacity. Permeability is moderately slow or slow in the subsoil and is slow in the substratum. The soils are—

Humboldt silt loam, moderately deep over clay, drained.
Humboldt silt loam, moderately deep over clay.
Humboldt silt loam, shallow over clay, drained.
Humboldt silt loam, shallow over clay.
Ryepatch silty clay loam, drained.
Ryepatch silty clay loam.

All crops suited to the climate can be grown successfully on these soils. The main crops grown, generally in rotation, are alfalfa or alfalfa-grass mixtures, row crops, and small grain. Permanent grass-legume pasture also is well suited. The kinds and the sequence of crops in a rotation are determined in part by the supply of irrigation water available. Crop yields are increased if fertilizer is applied. Excessive tillage should be avoided because it breaks down the structure of the soil, causes deterioration in tilth, and reduces the water-intake rate.

Artificial drainage is required for removing excess water, controlling the water table, and preventing an accumulation of salts and alkali in the root zone of alfalfa and other deep-rooted crops. Care in irrigating is essential to avoid a temporary perched water table above the clay stratum and a general rise in the ground water during the irrigation season.

These soils hold 10 to 11 inches of moisture available to plants between the surface and a 5-foot depth. Furrows are most suitable for irrigating row crops, and border flooding for other crops. Irrigation runs can be moderate or long, depending on the head of water available and the spacing of the borders. Leveling is needed in some places for efficient use of water.

CAPABILITY UNIT IIw-35

In this capability unit are dark-colored, friable silty clays that are more than 60 inches deep and are moderately well drained or imperfectly drained. These soils occur on the river delta and flood plain on slopes of 0 to 2 percent. Some are underlain by clay that reduces their permeability. All of these soils are fertile and highly productive, but they are somewhat difficult to work. Permeability is moderately slow or slow in the subsoil and is slow in the substratum. The available water capacity is high. The soils are—

Humboldt silty clay, moderately deep over clay.
Humboldt silty clay, shallow over clay.
Ryepatch silty clay, drained.
Ryepatch silty clay.

All crops that are suited to the climate do well on these soils. Alfalfa or alfalfa-grass mixtures, row crops,

and small grain are the principal crops and are generally grown in rotations. Permanent grass-legume pasture also does well. Potatoes are poorly suited because of the fine-textured surface layer. These soils should be tilled only when necessary, as excessive cultivation can result in less favorable structure. If the soils are tilled when wet, the surface layer will not scour a plow and is likely to puddle.

Artificial drainage must be provided so that the water table can be kept at a safe level for alfalfa and other deep-rooted crops. If the ground water is allowed to rise, it brings into the soil salts and alkali that can lower crop yields.

The root zone of these soils, to a depth of 5 feet, holds 11 inches of moisture that is available to plants. Applying water carefully keeps the water table from rising during the irrigation season. Suitable methods of irrigation are the furrow method for row crops and border flooding for other crops. Because the surface layer is fine textured, long irrigation runs are permissible, but the length of run is partly determined by the head of water available and the width of strips between borders. Some leveling may be needed for efficient irrigation.

CAPABILITY UNIT IIw-5

In this capability unit are dark-colored, friable silty clays that occur on the flood plain, are more than 60 inches deep, and are imperfectly drained. Slopes range from 0 to 2 percent. These soils are high in fertility and are very productive. They have a high available water capacity but are somewhat difficult to work. Their permeability is moderately slow in the subsoil and the substratum. The soils are—

Humboldt silty clay.
Humboldt silty clay, drained.

Most crops suited to the climate can be grown on these soils, but the best suited crops are alfalfa or alfalfa-grass mixtures grown in rotation with a row crop or small grain. Also well suited are grass-legume mixtures used for permanent pasture. Because the surface layer is fine textured, potatoes are not suited. All crops respond well to fertilizer. The number of tillage operations should be kept to the minimum since excessive tillage can result in less favorable soil structure. If the surface layer is plowed when too wet, it will not scour a plow and is likely to puddle.

Between the surface and a depth of 5 feet, these soils hold about 10 inches of moisture available to plants. Care in irrigating is essential to keep the high water table from rising even higher. Water can be effectively applied to row crops from furrows and to other crops by border flooding. Long irrigation runs are suitable because of the fine-textured surface layer, but the length of runs varies according to the amount of water available and the distance between borders. Some fields should be leveled for efficient irrigation.

Artificial drainage is required to remove excess water and thereby to control the water table during the irrigation season. If the ground water rises into the root zone of alfalfa and other deep-rooted crops, it will cause, just above the water table, an accumulation of salts and alkali that is likely to reduce the yield of crops.

CAPABILITY UNIT IIw-6

In this capability unit are dark-colored and light-colored, friable loams, silt loams, and silty clay loams that lie on the flood plain of the Humboldt River. Slopes range from 0 to 2 percent. These soils are more than 60 inches deep, are imperfectly drained, and contain slight concentrations of excess salts and alkali. They are fertile, easy to work, and productive; they have a high available water capacity. Permeability is moderate or moderately slow in the subsoil, and it ranges from moderately slow to moderately rapid in the substratum. The soils are—

Humboldt silt loam, slightly saline-alkali.
Humboldt silt loam, moderately coarse substratum, slightly saline-alkali.
Placeritos loam, slightly saline-alkali.
Placeritos loam, over silty clay loam, slightly saline-alkali.
Sonoma silt loam, slightly saline-alkali.
Sonoma silty clay loam, slightly saline-alkali.

These soils can be used for all crops that are tolerant of salts and alkali and are suited to the climate. The best suited crops are alfalfa or alfalfa-grass and barley, grown in rotation, and grass-legume mixtures used for permanent pasture. Except for sugar beets, row crops are not suited. The crops selected for a rotation, as well as the length of time they are grown, depend on the supply of irrigation water available. Crops respond well to added fertilizer, but phosphate may be less available than other nutrients.

The sodium contained in these soils is slightly harmful because it causes the clay particles to disperse in water. Then the soil puddles and seals over and, on drying, crusts on the surface. This affects the germination of seedlings, delays or prevents the emergence of some seedlings, and slightly reduces the intake of water. Applying gypsum to the surface layer, and then leaching with excess water, aids in removing excess salts and helps prevent crusting. Light, frequent irrigations also prevent crusting by keeping the surface moist.

Artificial drainage is needed to control the water table during the irrigation season. Unless the soils are drained, the water table rises into the root zone of alfalfa and other deep-rooted crops. As the water table rises, excess salts and alkali concentrate in the soil.

These soils commonly need leveling for efficient irrigation. They hold 8.5 to 9.5 inches of water available to plants between the surface and a depth of 5 feet. Suitable methods of irrigation are furrows for row crops and border flooding for other crops. Runs can be long because of the reduced rate of water intake, but the length of runs is partly determined by the head of water available and the width of strips between borders.

CAPABILITY UNIT IIw-0

Lovelock silt loam, drained, is the only soil in this capability unit. It is a dark-colored, very friable, stratified soil that occupies slopes of 0 to 2 percent on the delta of the Humboldt River. It is more than 60 inches deep and is imperfectly drained. This soil is highly fertile, very productive, and easy to work, but it is likely to blow severely if left exposed to the wind. It is moderately permeable in the subsoil and the substratum and has a high available water capacity.

All crops suited to the climate do well on this soil. Alfalfa or alfalfa-grass mixtures, row crops, and small grain are best suited and are generally grown in rotation. The choice of crops and the rotation used depend partly on the supply of water available for irrigation.

Because the soil has a high content of diatomaceous earth and volcanic glass, all crops respond to heavy applications of fertilizer, particularly phosphate. To control wind erosion, stubble and other crop residue should be left standing as long as possible. If the residue cannot be managed in this way, the surface should be rough plowed to minimize the damage from soil blowing. By returning grain stubble to the soil rather than burning it, the organic-matter content is maintained at a high level.

Leveling is needed in some fields for efficient irrigation. Suitable methods of irrigating are furrows for row crops and border flooding for other crops. Runs can be moderate or long, depending on the head of water available and the width of strips between borders. The soil holds about 11 inches of moisture available to plants between the surface and a depth of 5 feet.

In applying water, care is needed to prevent overirrigation and a rise in the water table. Unless artificial drainage is maintained, the water table rises into the root zone of alfalfa and other deep-rooted crops during the irrigation season. Then salts and alkali accumulate in the soil and cause a reduction of crop yields.

CAPABILITY UNIT IIw-03

In this capability unit are dark-colored, very friable, imperfectly drained silt loams that are more than 60 inches deep. These soils occur on the delta on slopes of 0 to 2 percent. They are highly susceptible to wind erosion if they are left unprotected. These soils are fertile, highly productive, and easy to work, and they have a high available water capacity. They are moderately permeable in the subsoil but are slowly permeable below it, because their substratum is clay. The soils are—

Lovelock silt loam, moderately deep over clay, drained.
Lovelock silt loam, shallow over clay, drained.

All crops suited to the climate can be grown successfully on these soils. The best suited crops are alfalfa or alfalfa-grass mixtures, row crops, and small grain. These are generally grown in rotations. The crops and the rotation used are selected partly on the basis of the amount of water available. All crops respond to heavy applications of fertilizer, particularly phosphate, because the soils contain a large amount of diatomaceous earth and volcanic glass.

If stubble and other crop residue are left standing as long as possible, the soil is protected from strong winds. When residue cannot be so managed, the soil can be somewhat protected by rough plowing. To maintain a high content of organic matter, grain stubble should be turned under instead of burned.

Leveling is commonly needed to prepare these soils for efficient irrigation. Suitable methods of irrigating are furrows for row crops and border flooding for other crops. Runs can be moderate or long, depending on the head of water available and the spacing of the borders. Between the surface and a depth of 5 feet, these soils hold 10 to 11 inches of available water.

Care is needed in irrigating to prevent excess water from accumulating over the clay stratum and forming a temporary perched water table that may injure crop roots. If adequate drainage is maintained, the water table is kept at a relatively safe level, and the salt balance remains favorable. Continued overirrigation causes a rise in the water table and a subsequent increase of soluble salts in the root zone.

CAPABILITY UNIT IIIw-356

In this capability unit are dark-colored, friable silty clays that occur on the flood plain and delta of the Humboldt River and are more than 60 inches deep. Slopes range from 0 to 2 percent. These soils are slowly permeable, imperfectly drained, and slightly affected by excess salts and alkali. They are fertile and easy to work, and have a high available water capacity. Productivity is moderate. Permeability is moderately slow or slow in the subsoil and is slow in the substratum. The soils are—

Humboldt silty clay, moderately deep over clay, slightly saline-alkali.
Humboldt silty clay, shallow over clay, slightly saline-alkali.
Rycpatch silty clay, slightly saline-alkali.

These soils can be used for crops that are suited to the climate and are tolerant of salts and alkali. Crops best suited are barley and alfalfa or alfalfa-grass, grown in rotation. The soils also are well suited to grass-legume pasture. They are not suited to row crops, except sugar beets. The specific crops selected for a rotation, and the number of years they are grown, depend on the amount of water that can be obtained. Crops respond well to added fertilizer, but phosphate may be less available than other nutrients.

The sodium contained in these soils is slightly harmful because it causes the clay particles to disperse in water. Then the soil puddles and seals over and, on drying, crusts on the surface. This affects the germination of seeds, delays or prevents the emergence of some seedlings, and slightly reduces the intake of water. Applying gypsum to the surface layer, and then leaching with excess water, aids in removing sodium and helps prevent crusting. Crusting is also prevented by light, frequent irrigations, which keep the surface moist. Permeability is slow in these soils and, consequently, removing the harmful salts will likely be difficult.

Artificial drainage must be provided to lower the water table and provide an outlet for salts removed in leaching. If drains are not installed, the water table will rise into the root zone of alfalfa and other deep-rooted crops during the irrigation season. As the water table rises, excess salts and alkali concentrate in the soil.

These soils hold 10 inches of moisture available to plants between the surface and a depth of 5 feet. The fine-textured surface layer and the slight accumulation of salts and alkali slow the intake of water. For this reason, long irrigation runs are permissible. Suitable methods of irrigation are furrows for row crops and border flooding for other crops. Some leveling may be needed for proper distribution of water.

CAPABILITY UNIT IIIw-36

In this capability unit are dark-colored and light-colored, friable silt loams and silty clay loams that occupy the delta and flood plain and are more than 60 inches deep. Slopes range from 0 to 2 percent. These soils are imperfectly drained and are slightly affected by salts and

alkali. Their permeability is slow or moderately slow in the subsoil and is slow in the clay substratum. These soils are fertile, productive, and easy to work. They are high in available water capacity. The soils are—

Humboldt silt loam, moderately deep over clay, slightly saline-alkali.
Humboldt silt loam, shallow over clay, slightly saline-alkali.
Ryepatch silty clay loam, slightly saline-alkali.
Sonoma silt loam, over clay, slightly saline-alkali.

These soils are suited to all salt- and alkali-tolerant crops that are suited to the climate. Best suited is a rotation of alfalfa or alfalfa-grass and barley or permanent pasture consisting of a grass-legume mixture. Except for sugar beets, row crops are not suited. The kinds and the sequence of crops in a rotation are partly determined by the amount of irrigation water available. Returning crop residue to the soil helps maintain good tilth. Applying fertilizer increases the yield of all crops, but phosphate may be less available than other nutrients.

The sodium in these soils causes the clay particles to disperse in water and, as a result, the surface becomes puddled and sealed. This condition slightly affects the germination and emergence of seedlings and reduces the intake of water. Applying gypsum to the surface layer aids in removing sodium and reduces crusting. Light, frequent irrigations also help prevent crusting by keeping the surface layer moist.

Artificial drainage is needed to lower the water table, provide an outlet for leached salts, and remove perched water that may accumulate above the clay substratum. Unless the soils are drained, the water table rises into the root zone of alfalfa and other deep-rooted crops during the irrigation season. As the water table moves upward, excess salts and alkali accumulate in the soil.

These soils hold 9 to 10 inches of available water between the surface and a depth of 5 feet. Furrows are suitable for irrigating row crops, and border flooding, for other crops. Careful irrigation is necessary to prevent a perched water table over the clay substratum. Leveling is needed in places for efficient distribution and use of water.

CAPABILITY UNIT IIIw-4

The only soil in this capability unit is Placeritos loam, over sand. This soil is light colored, friable, droughty, more than 60 inches deep, and imperfectly drained. It occupies slopes of 0 to 2 percent on the Humboldt River flood plain. It is a moderately fertile soil that is fairly productive, easy to work, and free of excess salts and alkali. Permeability is moderate in the subsoil but is very rapid in the coarse-textured substratum. The available water capacity is moderate.

All crops that are suited to the climate can be grown on this soil. Alfalfa or alfalfa-grass mixtures, small grain, and row crops are best suited and are generally grown in rotations. Crops and rotations are selected on the basis of the irrigation water available. Yields of all crops are increased if fertilizer is applied.

This soil holds 6 to 7 inches of available water in a 5-foot root zone. Because it occurs as narrow bands and is not extensive in any one field, it is irrigated at the same time as the surrounding soils that hold more water. Consequently, this soil is overirrigated when the more extensive adjacent soils are watered properly. Then, before the next irrigation, the soil dries too much for good growth of crops.

Seepage is excessive in irrigation ditches that cross this soil, but the loss of water can largely be eliminated by lining the ditches. In areas affected by a high water table, drains should be located so that they intercept the flow of water in the substratum. If this is done, the water table can be controlled and a favorable salt balance maintained, not only in this soil but also in adjacent soils.

CAPABILITY UNIT IIIw-46

Placeritos loam, over sand, slightly saline-alkali—the only soil in this capability unit—occurs on the flood plain of the Humboldt River. It is droughty, light colored, friable, and more than 60 inches deep. Slopes range from 0 to 2 percent. This soil is imperfectly drained and contains slight concentrations of harmful salts and alkali in the surface layer. It is moderately fertile, fairly productive, and easy to work. The available water capacity is moderate. Permeability is moderate in the subsoil and is very rapid in the sand substratum.

Because this soil occurs as small bodies in large fields of other soils, it is cropped like the other soils. It can be used for all salt- and alkali-tolerant crops that are suited to the climate. Best suited are permanent pasture of a grass-legume mixture and a rotation of alfalfa or alfalfa-grass and barley. Sugar beets are suited, but other row crops are not. Yields of all crops are increased by additions of fertilizer, but phosphate may be less available than other nutrients. Turning under crop residue helps to keep the soil in good tilth.

The excessive sodium in this soil is slightly harmful because it causes the clay particles to disperse or run together. If this occurs, the surface seals over when wet and crusts when dry. The sealing and crusting impair the germination of some seeds and prevent the emergence of some seedlings. Applying gypsum to the surface layer helps to remove sodium salts and tends to prevent crusting. Frequent light irrigations also check crusting by keeping the surface layer moist.

Because seepage is excessive, much water seeps into the sandy substratum from conveyance ditches that cross this soil. Also, deep percolation adds water to the substratum, for this soil is overirrigated when the surrounding soils are irrigated properly. For these reasons, drains dug across this soil remove excess water, control the water table in this and in adjacent soils, and help maintain a favorable salt balance.

Between the surface and a depth of 5 feet, this soil holds 6 to 7 inches of water available to plants. The management used on surrounding soils determines the frequency of irrigation and the length of run. Suitable for irrigating are furrows for row crops and border flooding for other crops.

CAPABILITY UNIT IIIw-56

Humboldt silty clay, slightly saline-alkali, is the only soil in this capability unit. It is a dark-colored, friable soil that occupies slopes of 0 to 2 percent on the delta and the flood plain. It is more than 60 inches deep, is imperfectly drained, and is slightly affected by excess salts and alkali. This soil produces high yields. It is high in fertility and available water capacity, but it is somewhat difficult to work. The subsoil and the substratum have moderately slow permeability.

This soil can be used for all crops that are suited to the climate and are tolerant of salts and alkali. Crops best suited are barley and alfalfa or alfalfa-grass, grown in rotation. Also well suited are grass-legume mixtures used for permanent pasture. Except for sugar beets, the soil is not suited to row crops. The crops selected for a rotation, and the number of years they are grown, depend on the amount of irrigation water available.

The surface layer of this soil contains excessive sodium that is adsorbed by the clay. This causes the surface to seal over when wet and to crust when dry. The sealing and crusting slightly impair the germination of seeds and prevent the emergence of some seedlings. Applying gypsum to the surface layer helps to remove sodium and, as a result, tends to reduce crusting. Keeping the surface moist through light, frequent irrigations also checks crusting.

Improving this soil by lowering the amount of salts and alkali should not be difficult, because the permeability of the subsoil and substratum is only moderately slow. Heavy applications of water are needed to leach away soluble salts. Artificial drainage is needed to lower the water table and to provide an outlet for leached salts. If drains are not installed, the water table rises into the root zone of alfalfa and other deep-rooted crops. As the water table rises, excess salts and alkali accumulate in the soil.

This soil holds about 9 inches of available water between the surface and a depth of 5 feet. Because the surface layer is clayey and is slightly saline-alkali, the intake of water is slow. Consequently, long irrigation runs are permissible. Suitable in applying water are the furrow method for row crops and border flooding for other crops. In places that are difficult to irrigate efficiently, some leveling may be needed.

CAPABILITY UNIT IIIw-036

The only soil in this capabiilty unit is Lovelock silt loam, moderately deep over clay, drained, slightly saline. This soil occurs on the delta and is dark colored, very friable, imperfectly drained, and more than 60 inches deep. Slopes range from 0 to 2 percent. This soil produces moderate yields, is high in fertility, is easy to work, and has a high available water capacity. Permeability is moderate in the subsoil and is slow in the substratum. Wind erosion occurs when the soil is not protected by clods, growing vegetation, or crop residue.

All salt- and alkali-tolerant crops that are suited to the climate can be grown on this soil. The best suited crops are alfalfa or alfalfa-grass grown in rotation with sugar beets or small grain. The kind and the sequence of crops in a rotation are partly determined by the amount of irrigation water available.

Crops respond well to large additions of fertilizer, particularly phosphate, because the soil contains a large amount of diatomaceous earth and volcanic glass. Wind erosion can be controlled by leaving stubble and other crop residue on the soil as long as possible. In places where residue cannot be left, rough plowing gives some protection. Grain stubble returned to the soil helps maintain the content of organic matter.

The root zone of this soil, to a depth of 5 feet, holds 9 to 10 inches of moisture available to plants. Water can be efficiently applied to row crops from furrows and to other crops by border flooding. In irrigating, care must be taken to avoid a temporary perched water table above the slowly permeable substratum and to prevent a general rise in the level of the ground water during the irrigation season. The length of the run can be moderate or long, depending on the head of water available and the width of strips between borders. In some places the soil should be leveled to provide for more efficient use of irrigation water.

Drainage that removes excess soluble salts from the soil is essential. An occasional, large application of water helps to maintain a favorable salt balance, but continued overirrigation builds up the water table and, as a result, moves dissolved salts upward into the root zone.

CAPABILITY UNIT IIIw-06

The only soil in this capability unit is Lovelock silt loam, slightly saline. It is a dark-colored, stratified, very friable soil that lies on the delta, is more than 60 inches deep, and is poorly drained. Slopes range from 0 to 2 percent. This soil is slightly affected by soluble salts and has a water table within 20 to 36 inches of the surface during most of the irrigation season. The soil has low bulk density and is highly susceptible to wind erosion if it is not protected. It is fertile, productive, easy to work, and high in available water capacity. The subsoil is moderately permeable.

All crops that tolerate salts and are suited to the climate can be grown successfully on this soil. Best suited is a rotation of small grain and alfalfa or alfalfa-grass. Also well suited are grass-legume mixtures used for permanent pasture. Crop rotations that include alfalfa are 1 or 2 years shorter on this soil than on soils that are better drained, because the high ground water shortens the life of the alfalfa.

Crops respond to large additions of fertilizer, particularly phosphate, because the soil has a high content of diatomaceous earth and volcanic glass. Wind erosion can be controlled if stubble and other crop residue are left standing as long as possible. When residue cannot be managed in this way, some protection from wind is obtained if the soil is rough plowed. By returning grain stubble to the soil rather than burning it, the organic-matter content can be maintained at a high level.

In all areas of this soil, leveling is needed for the most efficient use of irrigation water. The depth of cuts made in leveling are limited only in those places where the machinery bogs down. The best time for leveling is early in spring, before irrigation is started, when the water table is at its lowest level.

This soil holds about 9 inches of available water between the surface and a 5-foot depth. Care in irrigating is required to avoid raising the water table. Row crops are effectively irrigated from furrows, and other crops by border flooding. The length of run depends on the head, or flow, of water and the width of strips between borders. Moderate or long runs are suitable.

If the existing drains are deepened to lower the water table, this soil can be improved by deep leaching with heavy applications of water.

CAPABILITY UNIT IIIs-L

The only soil in this capability unit is Quincy fine sand, over silty clay loam, 0 to 2 percent slopes. This soil is light colored, loose, coarse textured, and well drained. It

is more than 60 inches deep and occurs on terraces and on the flood plain. Although the soil is easy to work, its use is limited by low fertility, fair productivity, and a moderate available water capacity. Permeability is very rapid in the subsoil but is moderately slow in the underlying silty clay loam. Wind erosion is a moderate hazard if the soil is exposed for a long period.

This soil can be used for all crops suited to the climate. Alfalfa or alfalfa-grass in rotation with row crops or small grain is best suited. Because yields of small grain are generally poor, corn grown for silage generally is more profitable than small grain. The kinds and the sequence of crops in a rotation are partly determined by the amount of irrigation water available.

Because the soil has low natural fertility, all crops respond well to heavy applications of fertilizer and manure. The fertilizer is most effective if it is used in two applications. Part of the fertilizer should be applied just before planting time, and the rest as a topdressing before either the second or the third irrigation, the choice depending on the height of the crop. The content of organic matter can be increased by turning under all plant residue and the last crop of hay. Organic matter increases the capacity of the surface layer to hold water and supply nutrients, and it helps to reduce the erosion hazard.

Windbreaks further reduce the risk of soil blowing. In planting trees for a windbreak on this soil, the roots should be placed in the silty clay loam substratum. Trees planted in this way are not likely to compete with field crops for water and nutrients.

This soil holds 6 to 7½ inches of water available to plants between the surface and a depth of 5 feet. The surface layer and the subsoil, however, hold only three-fourths inch of available water per foot of depth. Consequently, this soil must be irrigated more often than the total available water capacity indicates. Water can be effectively applied to row crops from furrows and to other crops by border flooding. Short or moderate runs are most suitable, but the length of run depends on the head of water available and the distance between borders.

This soil can be irrigated more efficiently if it is leveled. Cuts are not limited in depth. Deep cuts improve the soil because they remove the overlying fine sand and expose the silty clay loam. Deep fills, however, impair a field because they consist largely or entirely of fine sand. Leveling is most beneficial if it improves the irrigation grade and yet leaves a layer of fine sand at a uniform depth throughout the field.

CAPABILITY UNIT IVw-356

Toy silty clay, strongly saline-alkali—the only soil in this capability unit—occupies the delta and the flood plain of the Humboldt River. It is a dark-colored soil that is more than 60 inches deep. Slopes range from 0 to 2 percent. This soil is high in natural fertility, but it is imperfectly drained and contains strong concentrations of salts and alkali that have several adverse effects. The soil is difficult to work and is only fairly productive. Though the water-holding capacity is high, only about one-half of the water held in the soil is available to plants. The subsoil and the substratum are very slowly permeable.

This soil is suited only to crops that are highly tolerant of salts and alkali. Best suited is a long rotation of tall wheatgrass and barley. The wheatgrass may be seeded alone or in mixture with sweetclover. All crops respond to applications of fertilizer, but phosphate may be less available than other nutrients.

The surface layer of this soil contains an excessive amount of sodium that is tightly adsorbed by the clay. This causes the surface to puddle or seal over when wet and to crust when dry. The sealing and crusting reduce the intake of water, interfere with germination of seeds, and prevent the emergence of seedlings. Applying gypsum to the surface layer, followed by deep leaching, helps to remove harmful sodium and thereby tends to reduce crusting. Keeping the surface moist through light, frequent irrigations also checks crusting. After a crop is well established, the frequency of irrigation can be reduced. Drains that are properly built and maintained provide the drainage needed to lower the water table and to leach away excess salts.

This soil holds 5 inches of available water between the surface and a depth of 5 feet. The clay surface layer and the strong concentration of salts and alkali make the intake rate of water very slow. For this reason, the soil is well suited to long irrigation runs that allow enough time for water to penetrate to a desirable depth. In places that are difficult to irrigate properly, leveling may be needed.

CAPABILITY UNIT IVw-36

Toy silty clay loam, strongly saline-alkali, is the only soil in this capability unit. It is a dark-colored, imperfectly drained soil that occurs on the delta and flood plain and is more than 60 inches deep. Slopes range from 0 to 2 percent. This soil is high in fertility, but it contains strong accumulations of salts and alkali that have several unfavorable effects. The soil is only fairly productive and is difficult to work. It has a high water-holding capacity, but only about half of the water held in the soil is available to plants. Permeability is very slow in the subsoil and the substratum.

This soil is suited only to those crops that are most tolerant of salts and alkali. Best suited is tall wheatgrass seeded alone or in mixture with sweetclover and grown in a long rotation with barley. Added fertilizer increases the yields of all crops, but the availability of phosphate may be less than that of other nutrients.

Excessive sodium contained in this soil causes the surface to crust and, as a result, hinders the germination of seeds and the emergence of seedlings. Crusting can be reduced by applying gypsum and a large amount of water and then by using light, frequent irrigations to keep the surface moist. After the seedlings have emerged, the frequency of irrigation can be reduced. Artificial drainage must be provided to lower the water table and to furnish an outlet for leached salts.

Because the available water capacity is lowered by excess salts and alkali, this soil holds only about 5 inches of water available to plants between the surface and a depth of 5 feet. The slow intake of water makes long irrigation runs permissible because they allow enough time for water to penetrate into the soil. Irrigating deeply is almost impossible, but in time the roots of tall wheatgrass are likely to enter the subsoil and the substratum and thereby increase the permeability of those layers.

CAPABILITY UNIT VIw-6

This capability unit consists of deep, poorly drained soils that occupy slopes of 0 to 2 percent on the flood plain and the delta. Most of these soils are strongly affected by salts or by salts and alkali. A water table occurs at a depth of 18 to 36 inches during most of the year, and flooding is likely in years when Humbolt Lake is abnormally high. The soils are—

Lovelock silt loam, strongly saline.
Lovelock silt loam, hummocky, strongly saline.
Lovelock silt loam, occasionally flooded, strongly saline.
Lovelock silt loam, overwashed, strongly saline.
Lovelock silt loam, shallow over clay, strongly saline.
Lovelock silt loam, hummocky, shallow over clay, strongly saline.
Ocala loam, strongly saline-alkali.
Sandy alluvial land.

These soils are too saline, too saline-alkali, or too coarse textured for cultivation. They are best suited to plants used for grazing.

The management of these soils is discussed in the section "Range Management," under the Wet Saline Bottoms range site, and in the section "Descriptions of Soils."

CAPABILITY UNIT VIIw-6

This capability unit is made up of moderately deep, imperfectly drained soils of the flood plain and the delta. Slopes range from 0 to 2 percent. Most of these soils are strongly affected by excess salts and alkali. The soils are—

Humboldt silt loam, strongly saline-alkali.
Humboldt silt loam, moderately coarse substratum, strongly saline-alkali.
Humboldt silt loam, moderately deep over clay, strongly saline-alkali.
Humboldt silt loam, shallow over clay, strongly saline-alkali.
Humboldt silty clay, strongly saline-alkali.
Humboldt silty clay, shallow over clay, strongly saline-alkali.
Kodak loamy fine sand, moderately deep.
Lahontan fine sandy loam, sandy variant, strongly saline-alkali.
Lahontan silt loam, strongly saline-alkali.
Lahontan silty clay loam, strongly saline-alkali.
Placeritos loam, strongly saline-alkali.
Placeritos loam, over sand, strongly saline-alkali.
Ryepatch silty clay loam, strongly saline-alkali.
Sonoma silt loam, strongly saline-alkali.
Sonoma silt loam, over clay, strongly saline-alkali.
Sonoma silty clay loam, strongly saline-alkali.

These soils are too saline-alkali or too sandy and droughty for cultivation. They are suitable only as range.

The management of these soils is discussed in the section "Range Management," under the Alkali Flats range site, and in the section "Descriptions of Soils."

CAPABILITY UNIT VIIs-4

In this capability unit are moderately coarse textured and coarse textured soils that occur on alluvial fans, terraces, and rolling foothills. These soils are nearly level to strongly sloping, well drained to excessively drained, and more than 20 inches deep. Most of them are gravelly or rocky. The soils are—

Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes.
Bluewing gravelly fine sandy loam, 2 to 8 percent slopes.
Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes.
Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes.
Unionville very rocky coarse sandy loam, 4 to 8 percent slopes.

These soils are too droughty or too gravelly or rocky for cultivation. They are best suited to plants used for grazing.

The management of these soils is discussed in the section "Range Management," under Desert Uplands range site, and in the section "Descriptions of Soils."

CAPABILITY UNIT VIIs-6

In this capability unit are strongly saline-alkali soils that occur on flood plains, terraces, and alluvial fans. The soils are—

Humboldt silt loam, drained, strongly saline-alkali.
Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes.
Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes.
Placeritos loam, drained, strongly saline-alkali.
Placeritos loam, over clay, drained, strongly saline-alkali.
Placeritos loam, over silty clay loam, drained, strongly saline-alkali.
Placeritos loam, terrace, strongly saline-alkali.
Sonoma silt loam, drained, strongly saline-alkali.

These soils are too strongly saline-alkali for cultivation. They are best suited to native plants used for grazing.

The management of these soils is discussed in the section "Range Management," under Alkali Flats range site, and in the section "Descriptions of Soils."

CAPABILITY UNIT VIIs-L

Only one soil—Quincy fine sand, 0 to 15 percent slopes—is in this capability unit. It is a deep, excessively drained soil that occurs as dunes on flood plains and terraces.

This soil is low in fertility. It is too sandy and too droughty for cultivation. Its management is discussed in the section "Range Management," under the Sand Hills range site, and in the section "Descriptions of Soils."

CAPABILITY UNIT VIIc-K

In this capability unit are nearly level to moderately sloping, medium-textured and moderately coarse textured soils that occur on alluvial fans and are more than 60 inches deep. They are—

Placeritos loam, drained.
Woolsey gravelly fine sandy loam, 2 to 8 percent slopes.

These soils receive so little rainfall that they are not suitable for dryland farming, and no water for irrigation is available.

The management of these soils is discussed in the section "Range Management," under the Desert Uplands range site, and in the section "Descriptions of Soils."

CAPABILITY UNIT VIIIs-4

Toulon very gravelly loam, 0 to 4 percent slopes, is the only soil in this capability unit. It is an excessively drained soil that occupies offshore lake bars and is underlain by stratified sand and gravel at a depth of less than 10 inches. Because the surface is covered by an erosion pavement of gravel that reduces the intake of water, and because the rainfall is very low, little or no vegetation grows on this soil.

This soil is not suitable for cultivation or as range. It is suitable only for recreation, wildlife, water supply, or esthetic purposes.

TABLE 7.—*Estimated average yields per acre of principal crops on selected irrigated soils*

[Yields in columns A are those to be expected over a period of years under common, or prevailing, management; yields in columns B are those to be expected under the best management practical. Absence of yield indicates the crop is seldom if ever grown on the soil]

Map symbol	Soil	Alfalfa		Wheat		Barley		Oats		Corn for silage		Irrigated pasture	
		A	B	A	B	A	B	A	B	A	B	A	B
		Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*A.U.S.*[1]	*A.U.S.*[1]
Ha	Humboldt silt loam	4	7	1	2	1	2	0.75	1	14	20	1	2
Hb	Humboldt silt loam, drained	5	8	1.25	2.25	1.25	2.25	1	1.5	16	22	1	2
Hc	Humboldt silt loam, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Hf	Humboldt silt loam, moderately coarse substratum	3	6	1	1.75	1	1.75	.6	1	10	15	.75	1.5
Hg	Humboldt silt loam, moderately coarse substratum, slightly saline-alkali	2	6	.5	1.75	.5	1.75	----	----	----	----	.5	1.5
Hi	Humboldt silt loam, moderately deep over clay	4	7	1	2	1	2	.75	1	14	20	1	2
Hk	Humboldt silt loam, moderately deep over clay, drained	5	7.5	1.25	2.25	1.25	2.25	1	1.5	16	21	1	2
Hl	Humboldt silt loam, moderately deep over clay, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Hn	Humboldt silt loam, shallow over clay	4	7	1	2	1	2	.75	1	14	20	1	2
Ho	Humboldt silt loam, shallow over clay, drained	5	7.5	1.25	2.25	1.25	2.25	1	1.5	16	21	1	2
Hp	Humboldt silt loam, shallow over clay, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Hr	Humboldt silty clay	4	7	1	2	1	2	.75	1	14	20	1	2
Hs	Humboldt silty clay, drained	5	8	1.25	2.25	1.25	2.25	1	1.5	16	22	1	2
Ht	Humboldt silty clay, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Hv	Humboldt silty clay, moderately deep over clay	4	7	1	2	1	2	.75	1	14	20	----	----
Hw	Humboldt silty clay, moderately deep over clay, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Hx	Humboldt silty clay, shallow over clay	4	7	1	2	1	2	.75	1	14	20	1	2
Hy	Humboldt silty clay, shallow over clay, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Ld	Lovelock silt loam, drained	4	6	1	1.5	1	1.5	----	----	----	----	----	----
Lf	Lovelock silt loam, slightly saline	----	----	.5	1.5	.5	1.5	----	----	----	----	----	----
Ln	Lovelock silt loam, moderately deep over clay, drained	4	5	1	1.5	1	1.5	----	----	----	----	----	----
Lo	Lovelock silt loam, moderately deep over clay, drained, slightly saline	3	5	.8	1.5	.8	1.5	----	----	----	----	----	----
Lp	Lovelock silt loam, shallow over clay, drained	4	5	1	1.5	1	1.5	----	----	----	----	----	----
Pa	Placeritos loam	4	7	1	2	1	2	.75	1	14	20	----	----
Pd	Placeritos loam, drained	5	8	1.25	2.25	1.25	2.25	1	1.5	16	22	1	2
Pf	Placeritos loam, slightly saline-alkali	3	7	1	2	1	2	.6	2	----	----	.75	2
Pm	Placeritos loam, over silty clay loam, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Po	Placeritos loam, over sand	2	3	.5	.75	.5	.75	.3	.5	5	10	.5	.75
Pp	Placeritos loam, over sand, slightly saline-alkali	1	3	.5	.75	.5	.75	.3	.5	----	----	.25	.75
QtA	Quincy fine sand, over silty clay loam, 0 to 2 percent slopes	2.5	5	.75	1.25	.75	1.25	----	----	----	----	----	----
Ra	Ryepatch silty clay	4	7	1	2	1	2	.75	1	14	20	1	2
Rd	Ryepatch silty clay, drained	5	8	1.25	2.25	1.25	2.25	1	1.5	16	22	1	2
Rh	Ryepatch silty clay, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Rp	Ryepatch silty clay loam	4	7	1	2	1	1	.75	1	14	20	1	2
Rs	Ryepatch silty clay loam, drained	5	8	1.25	2.25	1.25	2.25	1	1.5	16	22	1	2
Rt	Ryepatch silty clay loam, slightly saline-alkali	3	7	1	2	2	2	.6	1	----	----	.75	2
Sm	Sonoma silt loam	4	7	1	2	1	2	.75	1	14	20	1	2
Sn	Sonoma silt loam, drained	5	8	1.25	2.25	1.25	2.25	1	1.5	16	20	1	2
So	Sonoma silt loam, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Ss	Sonoma silt loam, over clay, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2
Sv	Sonoma silty clay loam	4	7	1	2	1	2	.75	1	14	20	1	2
Sw	Sonoma silty clay loam, drained	5	8	1.25	2.25	1.25	2.25	1	1.5	16	22	1	2
Sx	Sonoma silty clay loam, slightly saline-alkali	3	7	1	2	1	2	.6	1	----	----	.75	2

[1] Animal units per season: the number of mature animals (cows, horses, or mules) that can graze 1 acre during the irrigation season without damage to pasture.

Estimated Yields

Table 7 lists average acre yields of alfalfa, wheat, barley, oats, corn for silage, and pasture that can be expected on selected irrigated soils in the Lovelock Area under two levels of management. In columns A are yields that can be expected under common, or prevailing, management. In columns B are yields that can be expected under the highest level of management that is now feasible. The estimates were prepared cooperatively by the Soil Conservation Service, the Nevada Agricultural Experiment Station, the Nevada Extension Service, and selected farmers and ranchers.

Management practices differ from farm to farm. To make wise decisions in organizing and managing his farm, a farmer needs to know the probable crop yields of his soils that he can expect under different systems of management. Those who have operated the same farm for many years know how their soils respond to the system of management used. Also, they are familiar with the experiences of their neighbors in working the same or similar soils. Those who have just moved to farms in the Area or have just begun to farm have soils that they know little about. To decide what crops to grow and how to manage the soils, farmers must estimate the yields they can expect from various systems of management. To assist these farmers, estimates of the average acre yields of important crops on selected irrigated soils of the Lovelock Area are shown in table 7.

Several important limitations should be kept in mind when using table 7. First, the yield figures are estimates, or predictions, rather than proven facts, but they are considered reliable enough to be valuable. Second, the estimates are of average yields that may be expected over a period of many years. They do not apply to any particular year when yields may be above or below the average because of the amount of irrigation water available and the length of the growing season. Third, there are variations in yields among areas of the same soil. Fourth, past management of a soil affects its immediate response to new management practices. Fifth, new crop varieties and improved farming practices are likely to increase future yields. Sixth, the availability of competent labor on the farm has an influence on yields.

Yields in columns A are obtained under the management common in the Lovelock Area. Under this management the crop rotation followed is too long for maximum production; little fertilizer and barnyard manure are used; irrigation water is not always applied uniformly and may not be in sufficient amounts and at the right time; there is little control of insect pests and weeds; and the practices used in preparing a seedbed and in cultivating are inadequate.

Farmers who obtain the yields in columns B follow the practices suggested for each capability unit. They also—

1. Use a planned rotation of crops.
2. Apply fertilizer at the following times and rates per acre:
   For *small grain*, 40 pounds of nitrogen and 20 pounds of P_2O_5 applied at planting time.
   For *alfalfa*, 30 pounds of nitrogen and 40 pounds of P_2O_5 applied at planting time. To keep alfalfa productive, 40 pounds of P_2O_5 applied every other year.
   For *potatoes*, 50 pounds of nitrogen and 60 pounds of P_2O_5 applied in either one or two applications.
   For *sugar beets*, 80 pounds of nitrogen if they follow alfalfa in the rotation; or if they follow small grain in the rotation, 120 pounds of nitrogen applied in two applications, the first before planting time, the second as side dressing before the young plants are thinned.
   For *onions*, 80 pounds of nitrogen applied in either one or two applications.
3. Add barnyard manure, as available, at the rate of 10 tons per acre.
4. Level the soil for efficient irrigation.
5. Apply water carefully at the right time and in the amounts needed.
6. Use gypsum for improving alkali soils according to the needs indicated by soil analyses.
7. Control weeds and insect pests.

Range Management

This subsection of the report discusses the principles of range management, defines range sites and condition classes, describes the range sites of the Lovelock Area, and discusses practices that help improve rangeland.

Principles of range management

The main principle of range management is the regulation of grazing so that the range produces vigorous stands of the most palatable and most nutritious forage plants. If grazing is properly managed, soil and water are conserved, watersheds are protected, and the highest production of livestock is obtained. Good management involves keeping a watchful eye on the condition of plants that occupy the soils. It includes grazing the range at the proper season, using practices to obtain uniform distribution of grazing, and selecting the proper kinds of grazing animals.

Range sites and condition classes

To manage the range properly, the operator who runs livestock must know the different combinations of plants that the soils can produce and the effect of grazing on these plants. To aid him in gaining his knowledge, the soils of the Lovelock Area have been grouped by range sites.

A *range site* is an area of natural grazing land that, because of its particular combination of climate, soils, and topography, will produce a particular kind and amount of vegetation. This combination of plants is generally the most productive vegetation that a site can produce and is called the potential plant community. Unless disturbed by overgrazing or other changes, a range site retains its capacity to produce this plant community.

Different range sites are recognized because of differences in the kinds or amounts of plants that make up their potential vegetation or because of significant differences in total yield if their potential vegetation is nearly the same.

Under intensive grazing, the cover of plants on rangeland is changed. Livestock graze selectively and con-

stantly seek the more palatable and nutritious plants. If grazing is not regulated, the best plants, called *decreasers*, are thinned out or eliminated. Less desirable plants, called *increasers*, take their place. If grazing pressure is too intense, even the second choice plants are weakened or eliminated and are replaced by undesirable plants, or *invaders*. Because the best forage plants are generally decreasers, an object of management is to keep these plants plentiful in the range. They are called key management plants.

Range condition is determined by comparing the kind and amount of present vegetation with the potential vegetation for that range site. Four condition classes are recognized. Range in excellent condition has from 76 to 100 percent of the vegetation that is characteristic of the potential vegetation on the same site; one in good condition, 51 to 75 percent; one in fair condition, 26 to 50 percent; and one in poor condition, less than 26 percent.

One of the main objectives of good range management is to keep the range in *excellent or good condition*. If this is done, yields are high, water is conserved, and the soils are protected. Recognizing important changes in the kind of cover on a range site may be difficult because these changes take place gradually and can be overlooked or misunderstood. Increased growth encouraged by heavy rainfall may lead to the conclusion that a range is improving, when actually the longtime trend is toward less desirable cover and less production. On the other hand, some rangeland that has been closely grazed for short periods under the supervision of a careful manager may have a degraded appearance that conceals its quality and ability to recover.

The productivity of a range site is expressed as *total annual yield*, which is the total yearly growth produced when the site is in excellent condition. This growth consists of leaves, nonwoody stems, twigs of the current year, flowers, and fruit. It includes the growth of all plants, even those that are inaccessible to livestock and to wildlife. It does not include the older twigs from trees and shrubs or the other plant growth left from previous years. Total annual yield is expressed as air-dry pounds per acre.

The total yearly growth of range plants provides forage for livestock and food and cover for wildlife. Also, it helps protect watersheds, may be valuable in recreation, and has other uses. For these reasons the yields shown for each range site indicate the growth of all plants that make up the vegetation. For specific kinds of livestock, the approximate amount of usable forage can be determined by taking samples of the plant cover and converting them to pounds per acre or by analyzing past records of grazing.

Descriptions of range sites

The soils of the Lovelock Area have been grouped into the four range sites described in the following pages. The description of each range site gives the important soil characteristics, the principal plants that occur when the site is in excellent condition, and the estimated total annual yield for favorable and for less favorable years. Soils that are only in irrigated areas have not been placed in range sites.

WET SALINE BOTTOMS

This range site is on the flood plain and delta of the Humboldt River. The average annual precipitation is only 5 to 6 inches, but seepage keeps the water table within 18 to 36 inches of the surface most of the year, and flooding is likely when Humboldt Lake is high.

The soils of this site are light colored or dark colored, nearly level, and medium textured. They have a high water-holding capacity, but only about half the water is available to plants because of salts. The soils are moderate to high in natural fertility. Permeability is moderate or moderately slow in the subsoil and the substratum. The erosion hazard is slight to moderate. The soils are—

- Lovelock silt loam, strongly saline.
- Lovelock silt loam, hummocky, strongly saline.
- Lovelock silt loam, occasionally flooded, strongly saline.
- Lovelock silt loam, overwashed, strongly saline.
- Lovelock silt loam, shallow over clay, strongly saline.
- Lovelock silt loam, hummocky, shallow over clay, strongly saline.
- Ocala loam, strongly saline-alkali.
- Sandy alluvial land.

In excellent condition 25 to 40 percent of the ground is covered by saltgrass, creeping wildrye, Great Basin wildrye, alkali sacaton, sedges, and other grasses and grasslike plants; iodineweed, bassia, and other forbs; and fourwing saltbush, rabbitbrush, greasewood, and other shrubs. The key management plants are Great Basin wildrye and alkali sacaton.

The total annual yield on a site in excellent condition is 2,000 pounds per acre in favorable years and 1,400 pounds in less favorable years.

ALKALI FLATS

This range site occurs mainly on the flood plain and delta of the Humboldt River. The average annual precipitation is 5 to 6 inches. The soils are nearly level, dark colored or light colored, and chiefly medium textured to fine textured. They are imperfectly drained to well drained and are more than 60 inches deep. In many areas the water table occurs at a depth of 4 or 5 feet, but in areas where the river is entrenched and functions as a drain, the water table is below a depth of 6 feet. Although the soils are strongly affected by salts and alkali, they are high in fertility and produce good yields of suitable plants. Their water-holding capacity is high, but only half of the moisture is available to plants because of excess salts. Except for the Kodak soil, which is highly susceptible to blowing, the erosion hazard on these soils is only slight. The soils are—

- Humboldt silt loam, strongly saline-alkali.
- Humboldt silt loam, drained, strongly saline-alkali.
- Humboldt silt loam, moderately coarse substratum, strongly saline-alkali.
- Humboldt silt loam, moderately deep over clay, strongly saline-alkali.
- Humboldt silt loam, shallow over clay, strongly saline-alkali.
- Humboldt silty clay, strongly saline-alkali.
- Humboldt silty clay, shallow over clay, strongly saline-alkali.
- Kodak loamy fine sand, moderately deep.
- Lahontan fine sandy loam, sandy variant, strongly saline-alkali.
- Lahontan silt loam, strongly saline-alkali.
- Lahontan silty clay loam, strongly saline-alkali.
- Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes.

Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes.
Placeritos loam, strongly saline-alkali.
Placeritos loam, drained, strongly saline-alkali.
Placeritos loam, over clay, drained, strongly saline-alkali.
Placeritos loam, over silty clay loam, drained, strongly saline-alkali.
Placeritos loam, over sand, strongly saline-alkali.
Placeritos loam, terrace, strongly saline-alkali.
Ryepatch silty clay loam, strongly saline-alkali.
Sonoma silt loam, strongly saline-alkali.
Sonoma silt loam, drained, strongly saline-alkali.
Sonoma silt loam, over clay, strongly saline-alkali.
Sonoma silty clay loam, strongly saline-alkali.

When this site is in excellent condition, 10 to 20 percent of the ground is covered by Great Basin wildrye, saltgrass, alkali sacaton, and other grasses; iodineweed, bassia, and other forbs; and greasewood, rabbitbrush, saltbush, and other shrubs. The key management plants are Great Basin wildrye and alkali sacaton.

On a site in excellent condition, the total annual yield is 1,100 pounds per acre in favorable years and 800 pounds per acre in less favorable years.

DESERT UPLANDS

This range site occurs on alluvial fans, terraces, and rolling foothills along the boundaries of the Area. The average annual precipitation is 5 to 6 inches. The soils are nearly level to sloping, more than 20 inches deep, light colored, medium textured to coarse textured, and well drained to excessively drained. They are underlain by gravel, many kinds of rocks, and lacustrine deposits. These soils range from high to low in fertility, but their yields of plants are low because rainfall is limited. Permeability is moderate to very rapid in the subsoil and is very rapid or moderate in the substratum. The available water capacity ranges from high to very low. The erosion hazard is slight or moderate. The soils are—

Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes.
Bluewing gravelly fine sandy loam, 2 to 8 percent slopes.
Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes.
Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes.
Placeritos loam, drained.
Unionville very rocky coarse sandy loam, 4 to 8 percent slopes.
Woolsey gravelly fine sandy loam, 2 to 8 percent slopes.

If this site is in excellent condition, about 5 percent of the ground is covered by Indian ricegrass, sand dropseed, squirreltail, and other grasses; globemallow, buckwheat, and other forbs; and bud sagebrush, upland greasewood, Douglas rabbitbrush, horsebrush, and other shrubs. The key management plant is Indian ricegrass.

On a site in excellent condition, the total annual yield is 250 pounds per acre in favorable years and 50 pounds per acre in years of lowest rainfall.

SAND HILLS

This range site is in areas of rolling dunes that are superimposed on nearly level flood plains and terraces. The average annual rainfall is 5 to 6 inches. Quincy fine sand, 0 to 15 percent slopes—the only soil in the site—is deep, light colored, coarse textured, and excessively drained. It has low fertility, very rapid permeability, and low available water capacity. Erosion, especially by wind, is a severe hazard if the plant cover is disturbed.

In excellent condition, this site has a plant cover that occupies 5 to 15 percent of the ground and consists of Indian ricegrass, needle-and-thread, squirreltail, bluestem wheatgrass, and other grasses; buckwheat, phlox, and other forbs; and greasewood, dahlia, rabbitbrush, spiny hopsage, fourwing saltbush, and other shrubs. The key management plants are Indian ricegrass and needle-and-thread.

On a site in excellent condition, the total annual yield is 450 pounds per acre in favorable years and 100 pounds per acre in less favorable years.

Practices for rangeland

Practices that apply to rangeland in the Lovelock Area are proper range use, allowing range readiness to determine start of grazing, rotation-deferred grazing, fencing, watering, and controlling poisonous plants.

Proper range use.—Proper use is the most important of all range practices. Without it, no other practice can be successful. Using range properly means that enough leaf surface is left to maintain or improve the desirable forage plants and to provide cover that protects the soils. The green leaves of plants convert air, water, and minerals from the soil into plant food by using energy from the sun. The food thus formed is stored in the plant tissues as starch, sugar, protein, fat, and other organic products. Because the manufacture of food takes place in the leaves, grazing needs to be limited. On level to sloping rangeland, no more than about half of the yearly growth of key management plants should be grazed if these and other plants on the range are to maintain themselves and produce their highest yield. In more strongly sloping areas, the proportion of growth removed by grazing should be decreased.

Range readiness.—Livestock should not be turned onto the range until the key management plants are ready to be grazed. The time of range readiness depends on the weather and on the elevation and aspect, or direction of slope, of each range area. In the Lovelock Area, range is considered ready for grazing when the height of new growth is 2 to 6 inches on alkali sacaton and saltgrass; 8 to 12 inches on Great Basin wildrye; and 4 to 7 inches on creeping wildrye, Indian ricegrass, and needle-and-thread.

Rotation-deferred grazing.—A system of rotation-deferred grazing is needed for the most efficient use of rangeland. Under this plan, each part of the range is rested at intervals during the growing season of the key management plants. Generally, no area is grazed more than half of any growing season or at the same time in successive years. If rotation-deferred grazing is to be successful, livestock must have adequate water, salt, and feed supplements. Livestock are encouraged to graze all parts of the range if salt and feed supplements are placed away from water and are moved periodically.

Fencing.—Adequate fencing is necessary to obtain good distribution of livestock and thus to manage rangeland properly. Useful in planning the location of fences are the soil map that accompanies this report, the descriptions of soils, and the lists of soils that make up the range sites.

Water.—Watering places should be distributed over the range as uniformly as possible and generally not more than 1 to 1½ miles apart.

Controlling poisonous plants.—Halogeton, a plant poisonous to livestock, commonly invades depleted rangeland. In this area halogeton can be controlled to some extent by using chemical sprays and by managing the better forage plants so that they increase in number and vigor. Reseeding is not practical because rainfall is too low.

Engineering Applications

This subsection contains information that will help engineers to select sites for buildings and other structures; to choose locations for highways; to locate sand and gravel for use in construction; and to predict future problems in construction and maintenance. The information will be of use largely by engineers and others who have a working knowledge of the principles of soil mechanics and have some familiarity with engineering groupings of soils. It has been developed largely from field observations and evaluations.

Information in this section is general and is not intended to eliminate the need for sampling and testing for design and construction of specific engineering works. The interpretations should be used primarily in planning more detailed field investigations to determine the condition of soil material in place at the site proposed for engineering work.

The soils of the Lovelock Area are in two general areas, the valley and the uplands. Soils in each area have distinctive qualities that are important to engineering.

The soils of the valley are either silty or clayey. While they were developing, drainage was imperfect, poor, or very poor. In many of these soils the organic-matter content is more than 2 percent, and in the Lovelock soils it is as much as 20 percent. Because soluble salts concentrated when saline capillary water evaporated, saline-alkali soils are extensive throughout the valley. Generally, the dominant salt is sodium bicarbonate, but chloride and sulfate salts of calcium, magnesium, and sodium are also common.

Soils of the uplands resemble soils of other arid areas in most respects. Weathering of the constituent rocks and minerals has been slow, leaching of soluble salts is incomplete, and the organic-matter content is low. These soils formed in deposits laid down in prehistoric Lake Lahontan or in alluvial fans superimposed on these deposits. The lacustrine material generally consists of stratified, poorly graded gravel and sand. The alluvial fans consist dominantly of fairly well-graded gravel and sand, though they have a high content of silt.

In the uplands along the western and the northeastern edges of the survey area, there are extensive deposits of construction material of good or excellent quality. In some places the material consists of gravel and sand that are stratified and poorly graded; in others it consists of

TABLE 8.—*Engineering*

[Dashes indicate information is not available

Map symbol	Soil	Depth from surface	Description of soil material [1]	Classification		Permeability
				Unified	AASHO	
		Inches				*Inches per hour*
BgC	Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes.	0–56	Mixture of gravel, sand, and silt that is about 5 percent cobbles; 40 percent subrounded and angular gravel not more than 3 inches across; 50 percent coarse to fine sand; and 5 percent nonplastic fines of low strength when dry. Calcareous and soft; pH 8.6.	SP-SM	A-1	10+
BlC	Bluewing gravelly fine sandy loam, 2 to 8 percent slopes.	0–8	Mixture of gravel, sand, and silt that is about 5 percent cobbles; 25 percent subrounded and angular gravel not larger than 3 inches across; 55 percent coarse to fine sand; and 15 percent nonplastic fines of low strength when dry. Calcareous and soft; pH 8.6.	SM	A-2	2.5–5.0
		8–56	Mixture of gravel, sand, and silt that is about 5 percent cobbles; 40 percent subrounded and angular gravel not more than 3 inches across; 50 percent coarse to fine sand; and 5 percent nonplastic fines of low strength when dry. Calcareous and soft; pH 8.8.	SP-SM	A-1	10+
BtB	Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes.	0–6	Mixture of gravel, silt, and sand that is about 5 percent cobbles and stones; 60 percent subrounded and angular gravel not more than 3 inches across; 20 percent medium and fine sand; and 15 percent slightly plastic fines. Calcareous; hard in place; pH 8.2.	GM	A-1 or A-2.	0.80–2.5
		6–16	Mixture of gravel, sand, and silt that is about 70 percent subrounded and angular gravel not more than 1 inch across; 25 percent coarse to fine sand; and 5 percent nonplastic fines of low strength when dry. Calcareous and loose; pH 8.0.	GP	A-1	10+
		16–30+	Mixture of silt and sand that is about 45 percent medium and fine sand and 55 percent slightly plastic fines. Cemented tufa, very hard in place; calcareous; pH 8.2.	---	---	---

See footnote at end of table.

fine, well-graded gravel and coarse sand. In preparing the material for use, crushing is generally not required, but screening may be necessary to obtain the size of sand and gravel needed for blending or to remove excessive fine sand or coarse gravel. This material has been extensively used in highway construction, as ballast in railroad beds, and as concrete aggregate. The supply will last for many years if it is used only in the Lovelock Area.

Engineering classification of soils

Many engineers classify soil materials according to the system used by either the American Association of State Highway Officials (*1*) or the Unified (*14*) classification. In both, the gradation of material passing the 3-inch sieve and the plasticity of this material are considered. The classification permits the engineer to appraise the soil material rapidly by comparing it with other soils having the same classification.

In the AASHO system, soil materials are classified in seven principal groups. The groups range from A–1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clayey soils having low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. These numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol.

In the Unified soil classification system, soil material is put into 15 classes that are designated by pairs of letters. The material is identified as coarse grained (eight classes), fine grained (six classes), or highly organic.

Engineering interpretations

In table 8 the material that makes up the important horizons of each soil in the survey area is briefly described in terms defined in the Unified system, and the horizons are classified according to the Unified and the AASHO methods. For many of the soils, the AASHO classification does not include the group index number, because the test data needed for calculating this number are not available.

Also given in table 8 are data on several soil characteristics that are significant to engineering, estimates of the suitability of the soils for specified uses, and ratings of the soil features that affect the location, design, construction, and maintenance of structures.

interpretations

for an estimate, or does not apply]

Shrink-swell potential	Susceptibility to frost action	Suitability for septic tank field	Stability in embankments	Bearing in foundations	Suitability of soil material for—			Suitability as source of—	
					Road subgrade	Road subbase	Road base	Gravel	Sand
Very low	None to very low.	Good	Fair	Good	Good to excellent.	Good	Fair to good.	Good	Good.
Very low	Low to high.	Good	Fair	Good to poor.	Fair to good.	Fair to good.	Poor	Fair	Fair.
Very low	None to very low.	Good	Fair	Good	Good to excellent.	Good	Fair to good.	Good	Good.
Very low	Low to moderate	Not suitable.	Fair	Good	Good to excellent.	Good	Fair to good.	Good	Poor.
Very low	None to very low.	Not suitable.	Fair	Good	Good to excellent.	Good	Fair to good.	Good	Fair.

TABLE 8.—*Engineering*

Map symbol	Soil	Depth from surface	Description of soil material [1]	Classification		Permeability
				Unified	AASHO	
		Inches				*Inches per hour*
Ha Hb Hc Hd He	Humboldt silt loam. Humboldt silt loam, drained. Humboldt silt loam, slightly saline-alkali. Humboldt silt loam, strongly saline-alkali. Humboldt silt loam, drained, strongly saline-alkali.	0–14	Mixture of sand, silt, and clay that is about 20 percent fine and medium sand and 80 percent slightly plastic fines of medium strength when dry. Calcareous; pH 8.4.	ML	A–4 or A–6.	0.80–2.5
		14–24	Mixture of silt and clay that is about 5 percent fine sand; 50 percent slightly plastic fines of medium strength when dry; and 45 percent very plastic fines. Calcareous; pH 8.4.	MH	A–7–5 (16).	0.20–0.80
		24–50	Mixture of silt and clay that is about 5 percent fine sand; 60 percent slightly plastic fines of medium strength when dry; and 30 percent very plastic fines. Calcareous; pH 8.4–8.8.	ML–CL	A–4(8)	0.20–0.80
Hf Hg Hh	Humboldt silt loam, moderately coarse substratum. Humboldt silt loam, moderately coarse substratum, slightly saline-alkali. Humboldt silt loam, moderately coarse substratum, strongly saline-alkali.	0–13	Mixture of sand, silt, and clay that is about 20 percent fine and medium sand and 80 percent slightly plastic fines of medium strength when dry. Calcareous; pH 8.6.	ML	A–4 or A–6.	0.80–2.5
		13–28	Mixture of silt and clay that is about 5 percent fine sand and 95 percent slightly plastic fines of medium strength when dry. Calcareous; pH 8.4.	MH	A–7–5 (16).	0.20–0.80
		28–60	Stratified sand and silt-sand that are about 20 percent nonplastic fines of low strength when dry and 80 percent coarse to fine sand. Calcareous; pH 8.6.	SM	A–1 or A–2.	2.5–5.0
Hi Hk Hl Hm	Humboldt silt loam, moderately deep over clay. Humboldt silt loam, moderately deep over clay, drained. Humboldt silt loam, moderately deep over clay, slightly saline-alkali. Humboldt silt loam, moderately deep over clay, strongly saline-alkali.	0–26	Mixture of sand, silt, and clay that is about 20 percent fine and medium sand and 80 percent slightly plastic fines of medium strength when dry. Calcareous; pH 8.2.	ML	A–4 or A–6.	0.80–2.50
		26–32	Mixture of silt and clay that is about 5 percent fine sand; 60 percent plastic fines of medium strength when dry; and 35 percent plastic fines. Calcareous; pH 8.4.	MH	A–7–5 (16).	0.20–0.80
		32–60	Inorganic clay that is 65 percent highly plastic fines and 35 percent slightly plastic fines. Calcareous; pH 8.4.	MH–CH	A–7–5 (20).	0.05–0.20
Hn Ho Hp Hq	Humboldt silt loam, shallow over clay. Humboldt silt loam, shallow over clay, drained. Humboldt silt loam, shallow over clay, slightly saline-alkali. Humboldt silt loam, shallow over clay, strongly saline-alkali.	0–18	Mixture of sand, silt, and clay that is about 20 percent fine and medium sand and 80 percent slightly plastic fines of medium strength when dry. Calcareous; pH 8.2.	ML	A–4 or A–6.	0. 80–2. 50
		18–35	Mixture of silt and clay that is about 40 percent slightly plastic fines and 60 percent plastic fines of medium strength when dry. Calcareous; pH 8.4.	MH	A–7–5(18).	0. 20–0. 80
		35–60	Inorganic clay that is about 65 percent very plastic fines and 35 percent slightly plastic fines. Calcareous; pH 8.6.	MH–CH	A–7–5(20).	0. 05–0. 20
Hr Hs Ht Hu	Humboldt silty clay. Humboldt silty clay, drained. Humboldt silty clay, slightly saline-alkali. Humboldt silty clay, strongly saline-alkali.	0–24	Mixture of silt and clay that is about 5 percent fine sand; 50 percent slightly plastic fines of medium strength when dry; and 45 percent very plastic fines. Calcareous; pH 8.4.	MH	A–7–5(16).	0. 20–0. 80
		24–60	Mixture of silt and clay that is about 5 percent fine sand; 60 percent slightly plastic fines of medium strength when dry; and 35 percent very plastic fines. Calcareous; pH 8.4–8.8.	ML–CL	A–4(8)	0. 20–0. 80

See footnote at end of table.

interpretations—Continued

Shrink-swell potential	Suscepti-bility to frost action	Suitability for septic tank field	Stability in embank-ments	Bearing in foundations	Suitability of soil material for— Road subgrade	Road subbase	Road base	Suitability as source of— Gravel	Sand
Low to moder-ate.	Moderate to very high.	Not suit-able.	Poor	Good to poor.	Poor to fair.	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
High	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate	Moderate to very high.	Not suit-able.	Poor	Good to poor.	Poor to fair.	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low to moder-ate.	Moderate to very high.	Not suit-able.	Poor	Good to poor.	Poor to fair.	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low	Moderate to high.	Not suit-able.	Good to fair.	Good to poor; de-pends on density.	Fair to good.	Fair to good.	Poor to not suitable.	Not suit-able.	Fair to poor.
Low to moder-ate.	Moderate to very high.	Not suit-able.	Poor	Good to poor.	Poor to fair.	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
High	Moderate	Not suit-able.	Fair to poor.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low to moder-ate.	Moderate to very high.	Not suit-able.	Poor	Good to poor.	Poor to fair.	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
High	Moderate	Not suit-able.	Fair to poor.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate	Moderate to very high.	Not suit-able.	Poor to good.	Good to poor.	Poor to fair.	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.

TABLE 8.—*Engineering*

Map symbol	Soil	Depth from surface	Description of soil material [1]	Classification		Permeability
				Unified	AASHO	
		Inches				*Inches per hour*
Hv Hw	Humboldt silty clay, moderately deep over clay. Humboldt silty clay, moderately deep over clay, slightly saline-alkali.	0–26	Mixture of silt and clay that is about 5 percent fine sand; 50 percent slightly plastic fines of medium strength when dry; and 45 percent very plastic fines. Calcareous; pH 8.4.	MH	A–7–5(15).	0. 20–0. 80
		26–32	Mixture of silt and clay that is about 5 percent fine sand; 50 percent plastic fines of medium strength when dry; and 45 percent very plastic fines. Calcareous; pH 8.4.	MH	A–7–5(16).	0. 20–0. 80
		32–60	Inorganic clay that is 65 percent very plastic fines and 35 percent slightly plastic fines. Calcareous; pH 8.6.	MH–CH	A–7–5(20).	0. 05–0. 20
Hx Hy Hz	Humboldt silty clay, shallow over clay. Humboldt silty clay, shallow over clay, slightly saline-alkali. Humboldt silty clay, shallow over clay, strongly saline-alkali.	0–18	Mixture of silt and clay that is about 5 percent fine sand; 50 percent slightly plastic fines of medium strength when dry; and 45 percent very plastic fines. Calcareous; pH 8.4.	MH	A–7–5 (15).	0.20–0.80
		18–35	Mixture of silt and clay that is about 30 percent slightly plastic fines and 70 percent plastic fines of medium strength when dry. Calcareous; pH 8.4.	MH	A–7–5 (18).	0.05–0.20
		35–60	Inorganic clay that is 65 percent very plastic fines and 35 percent slightly plastic fines. Calcareous; pH 8.6.	MH–CH	A–7–5 (20).	0.05–0.20
Ko	Kodak loamy fine sand, moderately deep.	0–9	Mixture that is 50 percent medium and fine sand; 35 percent nonplastic fines of low strength when dry; and 15 percent organic matter. Calcareous; pH 9.0.	OL	A–4	5.0–10.0
		9–31	Mixture that is about 15 percent organic matter; 35 percent medium and fine sand; and 50 percent nonplastic fines of low strength when dry. Calcareous; pH 8.8.	OL	A–4	2.5–5.0
		31–60	Mixture that is about 15 percent organic matter and 85 percent nonplastic fines containing diatomaceous earth and volcanic glass. Calcareous; pH 8.6.	OL	A–5	0.80–2.50
La	Lahontan fine sandy loam, sandy variant, strongly saline-alkali.	0–16	Mixture of silt and sand that is about 35 percent nonplastic fines of medium strength when dry and 65 percent coarse to fine sand. Calcareous; pH 9.2.	SM	A–4	2.50–5.0
		16–60	Inorganic clay that is about 65 percent very plastic fines and 35 percent slightly plastic fines. Calcareous; pH 9.0.	MH–CH	A–7–5 (20).	<0.05
Lb	Lahontan silt loam, strongly saline-alkali.	0–4	Mixture of sand, silt, and clay that is about 20 percent fine and medium sand and 80 percent slightly plastic fines of medium strength when dry. Calcareous; pH 9.4.	ML	A–6	0.80–2.50
		4–60	Mixture of silt and clay that is about 40 percent slightly plastic fines and 60 percent plastic fines of medium strength when dry. Calcareous; pH 8.6.	MH–CH	A–7–5 (18).	0.05–0.20
Lc	Lahontan silty clay loam, strongly saline-alkali.	0–4	Mixture of silt and clay that is about 5 percent fine sand; 65 percent slightly plastic fines of medium strength when dry; and 30 percent very plastic fines. Calcareous; pH 9.4.	MH	A–7–5 (16).	0.20–0.80
		4–60	Mixture of silt and clay that is about 60 percent plastic fines of medium strength when dry and 40 percent slightly plastic fines. Calcareous; pH 8.6.	MH–CH	A–7–5 (18).	0.05–0.20

See footnote at end of table.

interpretations—Continued

Shrink-swell potential	Suscepti-bility to frost action	Suitability for septic tank field	Stability in embank-ments	Bearing in foundations	Suitability of soil material for—			Suitability as source of—	
					Road subgrade	Road subbase	Road base	Gravel	Sand
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate	Not suit-able.	Fair to poor.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate	Not suit-able.	Fair to poor.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low to moderate.	Moderate to high.	Not suit-able.	Not suit-able.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low to moderate.	Moderate to high.	Not suit-able.	Not suit-able.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low	Moderate to high.	Not suit-able.	Not suit-able.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low to moderate.	Low to high.	Not suit-able.	Fair	Good to poor, de-pending on den-sity.	Fair to good.	Fair to good.	Not suit-able.	Not suit-able.	Poor.
Moderate to high.	Moderate	Not suit-able.	Fair to poor.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Low to moderate.	Moderate to very high.	Not suit-able.	Fair to poor.	Good to poor.	Poor to fair.	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate	Not suit-able.	Fair to poor.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate to very high.	Not suit-able.	Poor	Poor	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.
Moderate to high.	Moderate	Not suit-able.	Fair to poor.	Fair to poor.	Poor	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.

TABLE 8.—*Engineering*

Map symbol	Soil	Depth from surface	Description of soil material [1]	Classification: Unified	Classification: AASHO	Permeability
		Inches				*Inches per hour*
Ld Lf Lg Lh Lk Lm	Lovelock silt loam, drained. Lovelock silt loam, slightly saline. Lovelock silt loam, strongly saline. Lovelock silt loam, hummocky, strongly saline. Lovelock silt loam, occasionally flooded, strongly saline. Lovelock silt loam, overwashed, strongly saline.	0–60	Mixture that is about 15 percent organic matter and 85 percent slightly plastic fines containing diatomaceous earth and volcanic glass. Calcareous; pH 8.6.	OL	A-7-6	0.80–2.50
Ln Lo	Lovelock silt loam, moderately deep over clay, drained. Lovelock silt loam, moderately deep over clay, drained, slightly saline.	0–28	Mixture that is about 15 percent organic matter and 85 percent slightly plastic fines containing diatomaceous earth and volcanic glass. Calcareous; pH 8.6.	OL	A-7-6	0.80–2.50
		28–48	Mixture of clay and silt that includes about 10 percent organic matter and 40 percent slightly plastic fines. Calcareous; pH 8.6.	MH-OH	A-7-5	0.05–0.20
		48–60	Inorganic clay that is about 60 percent very plastic fines and 40 percent slightly plastic fines. Calcareous; pH 8.6.	MH-CH	A-7-5 (20).	0.05–0.20
Lp Lr Ls	Lovelock silt loam, shallow over clay, drained. Lovelock silt loam, shallow over clay, strongly saline. Lovelock silt loam, hummocky, shallow over clay, strongly saline.	0–18	Mixture that is about 15 percent organic matter and 85 percent slightly plastic fines containing diatomaceous earth and volcanic glass. Calcareous; pH 8.6.	OL	A-7-6	0.80–2.50
		18–44	Mixture of clay and silt that is about 10 percent organic matter; 40 percent slightly plastic fines; and 50 percent very plastic fines. Calcareous; pH 8.6.	MH-OH	A-7-5	0.05–0.20
		44–60	Inorganic clay that is about 60 percent very plastic fines and 40 percent slightly plastic fines. Calcareous; pH 8.6.	MH-CH	A-7-5 (20).	0.05–0.20
MaA	Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes.	0–30	Mixture of silt and sand that is about 35 percent nonplastic fines of medium strength when dry and 65 percent coarse to fine sand. Calcareous; pH 9.2.	SM	A-4	2.50–5.0
		30–60+	Mixture of silt and sand that is about 60 percent nonplastic fines of medium strength when dry and 40 percent medium to fine sand. Calcareous; pH 8.8.	ML or SM.	A-4	2.50–5.0
McA	Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes.	0–28	Mixture of silt and sand that is about 35 percent nonplastic fines of medium strength when dry and 65 percent coarse to fine sand. Calcareous; pH 9.2.	SM	A-4	2.50–5.0
		28–60	Inorganic clay that is 65 percent very plastic fines and 35 percent slightly plastic fines. Calcareous; pH 9.0.	MH-CH	A-7-5 (20).	<0.05
MgC	Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes.	0–28	Mixture of silt and sand that is about 30 percent nonplastic fines of medium strength when dry; 65 percent coarse to fine sand; and 5 percent fine gravel. Calcareous; pH 9.0.	SM	A-2	2.50–5.0
		28–60	Gravel and sand, some stratified and some well graded, that are about 70 percent rounded and subrounded gravel not more than 3 inches across; and 30 percent coarse to fine sand. Calcareous; pH 8.8.	GP-GW	A-1	10+

See footnote at end of table.

interpretations—Continued

Shrink-swell potential	Susceptibility to frost action	Suitability for septic tank field	Stability in embankments	Bearing in foundations	Suitability of soil material for— Road subgrade	Road subbase	Road base	Suitability as source of— Gravel	Sand
Moderate to high.	Moderate to high.	Not suitable.	Not suitable.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to high.	Moderate to high.	Not suitable.	Not suitable.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	High	Not suitable.	Not suitable.	Poor to very poor.	Poor to very poor.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to high.	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to high.	Moderate to high.	Not suitable.	Not suitable.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	High	Not suitable.	Not suitable.	Poor to very poor.	Poor to very poor.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to high.	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Very low	Low to high.	Fair to questionable.	Fair	Good to poor; depends on density.	Fair to good.	Fair	Not suitable.	Not suitable.	Poor.
Low	Moderate to very high.	Fair to questionable.	Fair to poor.	Good to very poor; depends on density.	Poor to fair.	Poor to not suitable.	Not suitable.	Not suitable.	Very poor.
Low to moderate.	Low to high.	Not suitable.	Fair	Good to poor; depends on density.	Fair to good.	Fair	Not suitable.	Not suitable.	Poor.
Moderate to high.	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Low	Low to very high.	Excellent	Fair to poor.	Good to very poor; depends on density.	Fair to poor.	Fair	Poor	Not suitable.	Poor.
Very low	None to very low.	Excellent	Fair to good.	Good	Good to excellent.	Good to excellent.	Fair to good.	Excellent	Good.

TABLE 8.—*Engineering*

Map symbol	Soil	Depth from surface	Description of soil material [1]	Classification		Permeability
				Unified	AASHO	
		Inches				*Inches per hour*
Om	Ocala loam, strongly saline-alkali.	0–10	Mixture of silt and sand that is about 35 percent medium and fine sand and 65 percent slightly plastic fines of medium strength when dry. Calcareous; pH 9.0.	ML	A–6	0.80–2.50
		10–14	Mixture of silt and clay that is about 15 percent fine sand; 50 percent slightly plastic fines of medium strength when dry; and 35 percent moderately plastic fines. Calcareous; pH 8.8.	ML–CL	A–7–6	0.20–0.80
		14–26	Mixture of silt and clay that is about 20 percent fine sand; 50 percent slightly plastic fines of high strength; and 30 percent plastic fines. Calcareous; pH 8.6.	ML	A–6	0.05–0.20
Pa Pd Pf Pg Ph	Placeritos loam. Placeritos loam, drained. Placeritos loam, slightly saline-alkali. Placeritos loam, strongly saline-alkali. Placeritos loam, drained, strongly saline-alkali.	0–60	Mixture of clay and silt that is about 25 percent moderately plastic fines and 75 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.4.	ML–CL	A–4(8)	0.80–2.50
Pk	Placeritos loam, over clay, drained, strongly saline-alkali.	0–50	Mixture of clay and silt that is about 25 percent moderately plastic fines and 75 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.8.	ML–CL	A–4(8)	0.80–2.50
		50–60	Inorganic clay that is 65 percent very plastic fines and 35 percent slightly plastic fines. Calcareous; pH 9.2.	MH–CH	A–7–5 (20).	<0.05
Pm Pn	Placeritos loam, over silty clay loam, slightly saline-alkali. Placeritos loam, over silty clay loam, drained, strongly saline-alkali.	0–24	Mixture of clay and silt that is about 25 percent moderately plastic fines and 75 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.8.	ML–CL	A–4(8)	0.80–2.50
		24–60	Mixture of clay and silt that is about 35 percent moderately plastic fines and 65 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.8.	ML–CL	A–7–6(11).	0.20–0.80
Po Pp Pr	Placeritos loam, over sand. Placeritos loam, over sand, slightly saline-alkali. Placeritos loam, over sand, strongly saline-alkali.	0–24	Mixture of clay and silt that is about 25 percent moderately plastic fines and 75 percent plastic fines of medium strength when dry. Calcareous; pH 8.8.	ML–CL	A–4(8)	0.80–2.50
		24–60	Sand, some well graded and some stratified and poorly graded; about 98 percent coarse to fine sand and 2 percent nonplastic fines of low strength when dry. Calcareous; pH 8.6.	SP–SW	A–3	10+
Ps	Placeritos loam, terrace, strongly saline-alkali.	0–39	Mixture of clay and silt that is about 25 percent moderately plastic fines and 75 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.8.	ML–CL	A–4(8)	0.80–2.50
		39–60	Stratified, poorly graded sand and silt-sand consisting of about 20 percent nonplastic fines of medium strength when dry; 75 percent coarse to fine sand; and 5 percent rounded and subrounded gravel not more than 1 inch across. Calcareous; pH 8.2–8.6.	SM	A–2	5.0–10
QfD	Quincy fine sand, 0 to 15 percent slopes.	0–60	Poorly graded sand consisting of about 85 percent fine and medium sand and 15 percent nonplastic fines of low strength when dry. Noncalcareous; pH 8.2.	SM	A–2	10+

See footnote at end of table.

interpretations—Continued

Shrink-swell potential	Susceptibility to frost action	Suitability for septic tank field	Stability in embankments	Bearing in foundations	Suitability of soil material for— Road subgrade	Road subbase	Road base	Suitability as source of— Gravel	Sand
Low to moderate.	Moderate to very high.	Not suitable.	Poor	Very poor	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate	Moderate to very high.	Not suitable.	Poor	Very poor	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Low to moderate.	Moderate to very high.	Questionable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Low to moderate.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
High	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Low to moderate.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Low to moderate.	Moderate to very high.	Questionable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
None	None	Questionable.	Very good to good.	Good to poor; depends on density.	Fair	Fair to good.	Poor to not suitable.	Not suitable.	Excellent.
Low to moderate.	Moderate to very high.	Good	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
None	None	Good	Good to fair.	Good to poor; depends on density.	Fair to good.	Fair	Poor to not suitable.	Not suitable to a depth of 5 feet.	Good.
None	None	Good	Good	Good to poor; depends on density.	Fair	Fair	Poor to not suitable.	Not suitable.	Poor.

TABLE 8.—*Engineering*

Map symbol	Soil	Depth from surface	Description of soil material [1]	Classification		Permeability
				Unified	AASHO	
		Inches				*Inches per hour*
QtA	Quincy fine sand, over silty clay loam, 0 to 2 percent slopes.	0–28	Poorly graded sand consisting of about 85 percent fine and medium sand and 15 percent nonplastic fines of low strength when dry. Noncalcareous; pH 8.2.	SM	A-2	10+
		28–60	Mixture of clay and silt that is about 35 percent moderately plastic fines and 65 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.8.	ML–CL	A-7-6 (11).	0.20–0.80
Ra Rd Rh	Ryepatch silty clay. Ryepatch silty clay, drained. Ryepatch silty clay, slightly saline-alkali.	0–15	Elastic silt that is about 7 percent fine sand; 33 percent nonplastic fines of medium strength when dry; and 60 percent moderately plastic fines. Calcareous; pH 8.2.	MH	A-7-5 (18).	0.05–0.20
		15–60	Fat clay that is about 2 percent fine sand; 23 percent nonplastic fines of medium strength when dry; and 75 percent plastic fines. Calcareous; pH 8.2.	MH-CH	A-7-5 (20).	0.05–0.20
Rp Rs Rt Ry	Ryepatch silty clay loam. Ryepatch silty clay loam, drained. Ryepatch silty clay loam, slightly saline-alkali. Ryepatch silty clay loam, strongly saline-alkali.	0–15	Mixture of clay and silt that is about 35 percent moderately plastic fines and 65 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.2.	ML–CL	A-7-6 (11).	0.20–0.80
		15–60	Fat clay that is about 2 percent fine sand; 23 percent nonplastic fines of medium strength when dry; and 75 percent plastic fines. Calcareous; pH 8.2.	MH-CH	A-7-5 (20).	0.05–0.20
Sa	Sandy alluvial land.	0–60	Highly stratified sand, nonplastic fines, and plastic silt; no orderly arrangement or thickness.	SP to MH	A-3 to A-7-6(18).	------------
Sm Sn So	Sonoma silt loam. Sonoma silt loam, drained. Sonoma silt loam, slightly saline-alkali.	0–13	Mixture of clay and silt that is about 5 percent fine sand; 25 percent plastic fines; and 70 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.4.	ML-CL	A-6(9)	0.80–2.50
Sp Sr	Sonoma silt loam, strongly saline-alkali. Sonoma silt loam, drained, strongly saline-alkali.	13–60	Mixture of clay and silt that is about 5 percent fine sand; 35 percent plastic fines; and 60 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.4–8.6.	ML-CL	A-7-6 (11).	0. 20–0. 80
Ss St	Sonoma silt loam, over clay, slightly saline-alkali. Sonoma silt loam, over clay, strongly saline-alkali.	0–6	Mixture of clay and silt that is about 5 percent fine sand; 25 percent plastic fines; and 70 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.4.	ML-CL	A-6(9)	0. 80–2. 50
		6–24	Mixture of clay and silt that is about 5 percent fine sand; 35 percent plastic fines; and 60 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.4–8.6.	ML-CL	A-7-6 (11).	0. 20–0. 80
		24–60	Fat clay that is about 2 percent fine sand; 23 percent nonplastic fines of medium strength when dry; and 75 percent plastic fines. Calcareous; pH 8.6.	MH-CH	A-7-5 (20).	0. 05–0. 20
Sv Sw Sx Sy	Sonoma silty clay loam. Sonoma silty clay loam, drained. Sonoma silty clay loam, slightly saline-alkali. Sonoma silty clay loam, strongly saline-alkali.	0–60	Mixture of clay and silt that is about 5 percent fine sand; 35 percent plastic fines; and 60 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.2–8.6.	ML-CL	A-7-6 (11).	0. 20–0. 80

See footnote at end of table.

interpretations—Continued

Shrink-swell potential	Suscepti-bility to frost action	Suitability for septic tank field	Stability in embank-ments	Bearing in foundations	Suitability of soil material for—			Suitability as source of—	
					Road subgrade	Road subbase	Road base	Gravel	Sand
None	None	Not suitable.	Fair	Good to poor; depends on density.	Fair to good.	Fair	Poor to not suitable.	Not suitable.	Poor.
Moderate to very high.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to high.	Moderate to very high.	Not suitable.	Poor	Poor	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
High	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
High	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
		Not suitable.						Not suitable.	Not suitable.
Moderate	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.

TABLE 8.—*Engineering*

Map symbol	Soil	Depth from surface	Description of soil material [1]	Classification: Unified	Classification: AASHO	Permeability
		Inches				*Inches per hour*
TgB	Toulon very gravelly loam, 0 to 4 percent slopes.	0–10	Mixture of gravel, sand, and silt that is about 65 percent rounded and subrounded gravel not more than 3 inches across; 2 percent plastic fines; 18 percent medium and fine sand; and 15 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.8.	GM	A–1 or A–2.	0. 80–2. 50
		10–60	Poorly graded gravel that is about 90 percent rounded and subrounded gravel not more than 3 inches across; 5 percent rounded and subrounded cobbles not more than 9 inches across; 4 percent coarse and medium sand; and 1 percent nonplastic fines. Calcareous; pH 8.4.	GP–GW	A–1	10+
To	Toy silty clay, strongly saline-alkali.	0–9	Elastic silt that is about 5 percent fine sand; 35 percent nonplastic fines of medium strength when dry; and 60 percent moderately plastic fines. Calcareous; pH 8.5.	MH	A–7–5 (18).	0. 05–0. 20
		9–60	Fat clay that is about 2 percent fine sand; 23 percent nonplastic fines of medium strength when dry; and 75 percent plastic fines. Calcareous; pH 8.4.	MH–CH	A–7–5 (20).	0. 05–0. 20
Ty	Toy silty clay loam, strongly saline-alkali.	0–9	Mixture of clay and silt that is about 35 percent moderately plastic fines and 65 percent nonplastic fines of medium strength when dry. Calcareous; pH 8.5.	ML–CL	A–7–6 (11).	0. 20–0. 80
		9–60	Fat clay that is about 2 percent fine sand; 23 percent nonplastic fines of medium strength when dry; and 75 percent plastic fines. Calcareous; pH 8.4.	MH–CH	A–7–5 (20).	0. 05–0. 20
UnC	Unionville very rocky coarse sandy loam, 4 to 8 percent slopes.	0–9	Mixture of silt and sand that is about 5 percent plastic fines; 40 percent nonplastic fines of low strength when dry; and 55 percent coarse to fine sand. Calcareous; pH 8.6.	SM	A–4	2. 50–5. 0
		9–27	Poorly graded sand that is about 1 percent nonplastic fines; 10 percent nonplastic fines of low strength when dry; and 89 percent coarse and medium sand. Calcareous; pH 9.0.	SM	A–2	2. 50–5. 0
		27+	Granodiorite bedrock.			
WoC	Woolsey gravelly fine sandy loam, 2 to 8 percent slopes.	0–5	Mixture of silt and sand that includes about 10 percent plastic fines and 40 percent nonplastic fines of low strength when dry. Calcareous; pH 8.6.	SM	A–4	2. 50–5. 0
		5–21	Mixture of gravel, silt, and sand that is about 30 percent angular and subrounded gravel not more than 2 inches across; 7 percent plastic fines; 28 percent nonplastic fines of low to medium strength when dry; and 35 percent coarse to fine sand. Calcareous; pH 8.6.	SM	A–4	0. 80–2. 50
		21–44	Mixture of silt and sand that is about 15 percent angular and subrounded gravel not more than 3 inches across; 5 percent plastic fines; 30 percent nonplastic fines of medium strength when dry; and 50 percent coarse to fine sand. Calcareous; pH 8.8.	SM	A–4	0. 80–2. 50

[1] The terms *cobbles, gravel, sand,* and *fines* refer to the size of individual soil particles and are as defined in the Unified system. They are—
Cobbles: Larger than 3 inches.
Gravel: 3 inches to 4.7 millimeters.
Coarse gravel—3 to ¾ inch.
Fine gravel—¾ inch to 4.7 millimeters.

interpretations—Continued

Shrink-swell potential	Susceptibility to frost action	Suitability for septic tank field	Stability in embankments	Bearing in foundations	Suitability of soil material for— Road subgrade	Road subbase	Road base	Suitability as source of— Gravel	Sand
Very low	Low to moderate.	Good	Fair	Good	Good to excellent.	Good	Fair to good.	Poor to fair.	Good.
None	None	Good	Fair to good.	Good	Good to excellent.	Good to excellent.	Fair to good.	Excellent	Poor.
Moderate to high.	Moderate to high.	Not suitable.	Poor	Poor	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
High	Moderate to high.	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Moderate to very high.	Moderate to very high.	Not suitable.	Poor to good.	Very poor to poor.	Poor to fair.	Not suitable.	Not suitable.	Not suitable.	Not suitable.
High	Moderate	Not suitable.	Fair to poor.	Fair to poor.	Poor	Not suitable.	Not suitable.	Not suitable.	Not suitable.
Very low	Low to high.	Not suitable.	Fair	Good to poor; depends on density.	Fair to good.	Fair to good.	Poor	Not suitable.	Poor.
Very low	Very low	Not suitable.	Fair	Good to poor; depends on density.	Fair to good.	Fair	Poor to not suitable.	Not suitable.	Fair.
Very low	Low to high.	Questionable.	Fair	Good to poor; depends on density.	Fair to good.	Fair to poor.	Poor	Not suitable.	Poor.
Very low	Low to moderate.	Questionable.	Fair	Good	Good to excellent.	Fair to good.	Very poor	Very poor	Poor.
Very low	Low to high.	Questionable.	Fair	Good to poor; depends on density.	Fair to good.	Fair to good.	Poor	Not suitable.	Poor.

Sand: 4.7 to 0.074 millimeters.
Coarse sand—4.7 to 2 millimeters.
Medium sand—2.0 to 0.42 millimeters.
Fine sand—0.42 to 0.74 millimeter.
Fines (silt and clay): Smaller than 0.074 millimeter.
In the AASHO system, the terms used to describe particle size differ slightly from these terms (*1*).

The shrink-swell potential indicates how much a soil changes in volume when its moisture content changes. In general, soils have a high or a very high shrink-swell potential if they are high in content of very plastic fines and are classified MH–CH and A–7, or if they are high in content both of organic matter and of very plastic fines and are classified MH–OH and A–7. Soils that have a very low shrink-swell potential are clean sands and gravel that are classified SP or GP and A–1 and sands and gravel that contain a small amount of non-plastic fines and are classified SM or GM and A-1 or A–2.

Frost action is the heaving and softening of a soil and is caused by freezing and thawing of water in the soil. The susceptibility of a soil to frost action depends on the texture, the length of time the temperature is below the freezing point, and the depth to the water table during that time. Rated highest in susceptibility are silts and fine silty sands in which the water table is high. Rated lowest are coarse-grained materials that contain little or no fines.

Under the column headed "Suitability for septic tank field," the ratings are for a 5-foot depth of soil. Considered in rating suitability were soil color, texture, structure, permeability, depth to and thickness of slowly permeable layers, and tendency to swell when wet. A soil has been rated as *excellent* if its permeability rate is more than 10 inches per hour, or if water falls more than 1 inch in 6 minutes. Suitability is *good* if the permeability rate is 5.0 to 10 inches per hour, or if water falls 1 inch in 6 to 12 minutes. The soil has *fair* suitability if the permeability rate is 2.5 to 5.0 inches per hour, or if water falls 1 inch in 12 to 24 minutes. A soil has *questionable* suitability if the permeability rate is 0.8 to 2.5 inches per hour, or if water falls 1 inch in 24 to 75 minutes. A soil has been rated as *unsuitable* for disposal of sewage from septic tanks if its texture is moderately fine or fine and the permeability rate is less than 0.8 inch per hour, or if water falls less than 1 inch in 75 minutes (*13*). Not considered in rating suitability were the materials that underlie the soils at a depth of more than 5 feet and the possible contamination of ground water in soils that have a permeability rate of more than 5 inches per hour.

The stability of soils in embankments depends largely on soil permeability, strength, and ease of compaction. Gravelly and sandy soils that have little or no fines and are classified GW or SW and A–1 are pervious to water, but they are stable and can easily be compacted by a crawler-type tractor and a rubber-tired roller. Of the fine-grained soils, those classified CL and A–4 or A–6 are best for embankments because they are impervious, are fairly stable, and can easily or fairly easily be compacted by a sheepsfoot roller or a rubber-tired roller. Soils containing a fairly large amount of organic matter and classed OL or OH are not commonly used in the construction of embankments.

In table 8 the soils have been rated according to their suitability for embankments and their bearing capacity for foundations. The suitability for embankments and similar structures depends largely on how well the soil material compacts and how strong it is after compaction. The suitability of soils as foundation for structures depends mainly on the type and the size of structure. For these reasons and others, the suitability for embankments may differ from that for foundations. In the construction of an embankment, a large amount of settling can safely be allowed by overbuilding the embankment. In the construction of concrete buildings and other structures, however, the amount of settling that can safely be allowed may be small because of a need to prevent overstressing the concrete or steel in the structure or to maintain an established grade. Thus, a soil that is satisfactory for one type of construction may require special treatment if used for other types. Consequently, the ratings of bearing capacity are only general, especially those of fine-grained soils. Gravel and gravelly soils classified GW, GP, GM, and GC generally have good bearing capacity and undergo little consolidation under load. Soils classified ML may be subject to liquefaction and may have poor bearing capacity, particularly under the load of heavy structures. Soils that contain a fairly large amount of organic matter and are classified OL and OH have poor bearing capacity and, as a rule, settle considerably under load.

The suitability ratings for road subgrade, road subbase, and road base are those of soil material not subjected to frost action. In areas where frost heaving is a problem, the susceptible soils should be rated lower than the ratings shown in the table. Generally the best soil material for subgrade, subbase, and base are coarse-grained soils. Soils classified GW or A–1 are rated excellent for subgrade and subbase because they are the source of material that can be processed into crushed stone of high quality. These soils are rated good as base material. The suitability of fine-grained soils for road subgrade ranges from fair to very poor. These fine-grained soils are classified ML, CL, OL, CH, MH, or OH and have an AASHO classification of A–4, A–5, A–6, or A–7. They are not suitable as material for road subbase and road base, because they have one adverse property or more—moderate to high shrink-swell potential, moderate to high susceptibility to frost action, low stability, poor bearing capacity, and slow internal drainage.

The ratings of soils as a source of gravel and sand are based on laboratory data and field observations. Soils consisting of well-graded gravel and sand are classified GW and SW. They are excellent sources of those materials, but none occur in the Lovelock Area. Soils containing poorly graded gravel and sand are classified GP and SP and are rated as a good source. Considered not suitable as a source of sand are soils that have a content of fine to coarse sand lower than 50 percent and soils that contain sand consisting mainly of shell fragments.

Engineering test data

To help evaluate the soils for engineering purposes, soil samples from four extensive soil series were tested by the Bureau of Public Roads. The results of these tests are given in table 9.

The data given in table 9 were obtained by mechanical analyses and by testing the soils to determine liquid limits and plastic limits. Mechanical analyses were made by combined sieve and hydrometer methods.

The tests to determine liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at

which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state.

Table 9 also gives the two engineering classifications for each soil sample. These classifications are based on the mechanical analyses, the liquid limit, and the plastic limit.

Managing Soils for Wildlife [2]

Several kinds of wildlife occur in the Lovelock Area. In the wet, low-lying lands that border Humboldt Lake and Toulon Lake, ducks and geese feed and rest during their fall and spring migrations. However, the water supply varies so much that many of these waterfowl do not nest in the Area.

The common game in cultivated areas are pheasant, valley quail, and mourning dove. More pheasants occur in the Lovelock Area than in most other parts of the State; the birds are most abundant when ample water is available. The number of valley quail per acre is higher in this Area than in the State as a whole. Mourning doves are plentiful in spring, summer, and fall.

Adjacent to the Humboldt River and along sloughs and ditches, a few mule deer range where willows grow in dense patches. These deer are rarely hunted.

Suitability of soils for wildlife

The distribution and abundance of wildlife depends on the suitability of the habitat. In the Lovelock Area the natural habitat has been changed in most places by growing cultivated crops and pasture. In these places the suitability of the soils for wildlife has changed and can be determined only by knowing the soils as they are now and the habitats they provide under good management.

In this Area the suitability of soils as sources of food or as habitats for wildlife is related to the agricultural use of the soil, the kind and density of the plant cover, and the topography. It depends on drainage, soil permeability, the salt and alkali content, and other characteristics or qualities.

Wildlife sites

The soils of the Lovelock Area have been placed in 12 wildlife sites according to their limitations for use as habitat and their suitability for four classes of wildlife. Each site is made up of soils that can provide about the same kind and amount of food and cover and that respond to management in about the same way.

Considered in rating the limitations and the suitability of each wildlife site were the kinds of plants suitable for each of the four classes of wildlife, and, for wetland wildlife, the limitations of the soils for impounding water.

Grain crops, grasses and legumes, and the hedgerow cover provided by native shrubs are suitable habitat for upland wildlife, including pheasant, valley quail, and mourning dove.

Grasses, legumes, and native sl are suitable habitat for cottontail rabbit and other kir rangeland wildlife.

Grain crops, grasses and legumes, and impoundments of shallow water are suitable for ducks, geese, and other kinds of migratory wetland wildlife.

[2] PAUL M. SCHEFFER, biologist, Soil Conservation Service, helped write this section.

730-494—65——5

Impoundments of deep water are suitable for nonmigratory wildlife, including beaver, muskrat, and mink.

The limitations of a site as habitat are *none to slight* if the specified kind of food and cover or type of water impoundment is more desirable than the average; *moderate* if the desirability is about average; *severe* if the desirability is below the average; and *very severe* if the specified item in the habitat is not useful to, or is not needed by, the wildlife.

The suitability of each site for kinds of wildlife is *excellent* if little management is needed to maintain or increase the wildlife in the named class. It is *good* if average management of the site is needed. Suitability is *poor* if wildlife can be maintained only with difficulty. The site is *not suitable* if maintenance of the specified wildlife is not feasible or is impossible.

The 12 wildlife sites of the Lovelock Area are discussed in the following pages.

WILDLIFE SITE 1

The soils in this wildlife site are—

Humboldt silt loam.
Humboldt silt loam, drained.
Humboldt silt loam, moderately deep over clay.
Humboldt silt loam, moderately deep over clay, drained.
Humboldt silt loam, shallow over clay.
Humboldt silt loam, shallow over clay, drained.
Humboldt silty clay.
Humboldt silty clay, drained.
Humboldt silty clay, moderately deep over clay.
Humboldt silty clay, shallow over clay.
Lovelock silt loam, drained.
Lovelock silt loam, moderately deep over clay, drained.
Lovelock silt loam, shallow over clay, drained.
Ryepatch silty clay.
Ryepatch silty clay, drained.
Ryepatch silty clay loam.
Ryepatch silty clay loam, drained.
Sonoma silt loam.
Sonoma silt loam, drained.
Sonoma silty clay loam.
Sonoma silty clay loam, drained.

Habitat limitations: None to slight for grain crops and for grasses and legumes; severe for shallow-water impoundments; very severe for native shrubs and for deep-water impoundments.

Suitability: Excellent for upland wildlife; poor for migratory wetland wildlife; not suitable for rangeland wildlife and for nonmigratory wetland wildlife.

WILDLIFE SITE 2

The soils in this wildlife site are—

Placeritos loam.
Placeritos loam, drained.

Habitat limitations: None to slight for grain crops and for grasses and legumes; very severe for native shrubs, for shallow-water impoundments, and for deep-water impoundments.

Suitability: Excellent for upland wildlife; not suitable for rangeland wildlife, for migratory wetland wildlife, and for nonmigratory wetland wildlife.

WILDLIFE SITE 3

The soils in this wildlife site are—

Humboldt silt loam, moderately coarse substratum.
Placeritos loam, over sand.

TABLE 9.—*Engineering test data* [1] *for soil samples*

Soil name and location	Parent material	Bureau of Public Roads report number	Depth	Horizon	Moisture-density	
					Maximum dry density	Optimum moisture
			Inches		*Pounds per cubic foot*	*Percent*
Humboldt silty clay: NW¼NW¼ sec. 35, T. 27 N., R. 31 E.	Alluvium.	S31701	0–8	Ap	84	32
		S31702	18–24	C2	85	32
NW¼NW¼ sec. 10, T. 26 N., R. 31 E.	Alluvium.	S31703	0–6	Ap	81	34
		S31704	31–48	C3	99	22
Placeritos loam: NW¼NW¼ sec. 31, T. 27 N., R. 32 E.	Alluvium.	S31707	0–5	Ap	100	21
		S31708	25–31	C3	100	21
Placeritos loam: SE¼SE¼ sec. 23, T. 27 N., R. 31 E.	Alluvium.	S31705	0–6	Ap	103	19
		S31706	26–35	IIC4	89	29
Ryepatch silty clay loam: NW¼NE¼ sec. 3, T. 25 N., R. 31 E.	Alluvium.	S31709	0–10	Ap	73	38
		S31710	25–39	B23+g	73	41
NE¼SE¼ sec. 28, T. 26 N., R. 31 E.	Alluvium.	S31711	0–10	Ap	78	37
		S31712	29–38	C2	82	35
Sonoma silty clay loam: SE¼SW¼ sec. 2, T. 26 N., R. 31 E.	Alluvium.	S31713	0–12	Ap	83	31
		S31714	22–32	C1	92	27
NW¼NW¼ sec. 1, T. 26 N., R. 31 E.	Alluvium.	S31715	0–8	Ap	94	25
		S31716	13–21	C1	98	23

[1] Tests performed by Bureau of Public Roads in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

[2] Mechanical analyses according to the AASHO Designation: T 88 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soils.

Habitat limitations: Moderate for grain crops and for grasses and legumes; very severe for native shrubs, for shallow-water impoundments, and for deep-water impoundments.

Suitability: Good for upland wildlife; not suitable for rangeland wildlife, for migratory wetland wildlife, and for nonmigratory wetland wildlife.

WILDLIFE SITE 4

The soils in this wildlife site are—

Humboldt silt loam, slightly saline-alkali.
Humboldt silt loam, moderately deep over clay, slightly saline-alkali.
Humboldt silt loam, shallow over clay, slightly saline-alkali.
Humboldt silty clay, slightly saline-alkali.
Humboldt silty clay, moderately deep over clay, slightly saline-alkali.
Humboldt silty clay, shallow over clay, slightly saline-alkali.
Lovelock silt loam, slightly saline.
Lovelock silt loam, moderately deep over clay, drained, slightly saline.
Placeritos loam, over silty clay loam, slightly saline-alkali.
Ryepatch silty clay, slightly saline-alkali.
Ryepatch silty clay loam, slightly saline- alkali.
Sonoma silt loam, slightly saline-alkali.
Sonoma silt loam, over clay, slightly saline-alkali.
Sonoma silty clay loam, slightly saline-alkali.

Habitat limitations: Moderate for grain crops and for grasses and legumes; severe for shallow-water impoundments; and very severe for native shrubs and for deep-water impoundments.

Suitability: Good for upland wildlife; poor for migratory wetland wildlife; not suitable for rangeland wildlife and for nonmigratory wetland wildlife.

WILDLIFE SITE 5

The only soil in this wildlife site is Placeritos loam, slightly saline-alkali.

Habitat limitations: Moderate for grain crops and for grasses and legumes; very severe for native shrubs, for shallow-water impoundments, and for deep-water impoundments.

Suitability: Good for upland wildlife; not suitable for rangeland wildlife, for migratory wetland wildlife, and for nonmigratory wetland wildlife.

WILDLIFE SITE 6

The soils in this wildlife site are—

Humboldt silt loam, moderately coarse substratum, slightly saline-alkali.

taken from eight soil profiles in the Lovelock Area

Mechanical analysis [2]										Classification	
Percentage passing sieve—				Percentage smaller than—				Liquid limit	Plasticity index		
No. 10 (2.0 mm.)	No 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
--------	--------	100	98	96	89	70	51	54	20	A-7-5(15)	MH.
--------	--------	100	99	99	96	80	59	57	22	A-7-5(16)	MH.
--------	--------	100	97	95	85	73	51	55	19	A-7-5(15)	MH.
100	99	99	98	95	64	30	22	36	10	A-4(8)	ML-CL.
100	99	97	89	84	58	32	24	35	12	A-6(9)	ML-CL.
--------	100	99	97	92	62	31	23	33	9	A-4(8)	ML-CL.
100	99	97	79	71	43	27	20	30	7	A-4(8)	ML-CL.
--------	--------	100	97	94	84	64	44	49	19	A-7-5(3)	ML.
100	99	98	92	90	86	73	60	69	25	A-7-5(18)	MH.
--------	--------	100	99	98	94	90	82	90	47	A-7-5(20)	MH or OH.
100	99	98	93	91	81	69	58	61	22	A-7-5(17)	MH.
--------	--------	100	98	96	92	83	67	77	40	A-7-5(20)	MH-CH.
100	99	99	97	96	88	61	41	54	20	A-7-5(15)	MH.
--------	--------	100	99	99	84	48	33	44	16	A-7-6(11)	ML-CL.
--------	--------	100	96	91	69	48	36	43	17	A-7-6(11)	ML-CL.
--------	--------	100	99	96	71	43	32	38	13	A-6(9)	ML-CL.

[3] Based on methods described in the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation: M 145-49 (*1*).

[4] Based on The Unified Soil Classification System, Technical Memo. No. 3-357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953 (*14*). SCS and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are ML-CL and MH-CH.

Placeritos loam, over sand, slightly saline-alkali.
Quincy fine sand, over silty clay loam, 0 to 2 percent slopes.

Habitat limitations: Severe for grain crops and for grasses and legumes; very severe for native shrubs, for shallow-water impoundments, and for deep-water impoundments.

Suitability: Poor for upland wildlife; not suitable for rangeland wildlife, for migratory wetland wildlife, and for nonmigratory wetland wildlife.

WILDLIFE SITE 7

The soils in this wildlife site are—

Humboldt silt loam, strongly saline-alkali.
Humboldt silt loam, moderately deep over clay, strongly saline-alkali.
Humboldt silt loam, shallow over clay, strongly saline-alkali.
Humboldt silty clay, strongly saline-alkali.
Humboldt silty clay, shallow over clay, strongly saline-alkali.
Lahontan fine sandy loam, sandy variant, strongly saline-alkali.
Lahontan silt loam, strongly saline-alkali.
Lahontan silty clay loam, strongly saline-alkali.
Lovelock silt loam, hummocky, strongly saline.
Lovelock silt loam, hummocky, shallow over clay, strongly saline.
Ocala loam, strongly saline-alkali.
Placeritos loam, over clay, drained, strongly saline-alkali.
Placeritos loam, over silty clay loam, drained, strongly saline-alkali.
Ryepatch silty clay loam, strongly saline-alkali.
Sonoma silt loam, strongly saline-alkali.
Sonoma silt loam, drained, strongly saline-alkali.
Sonoma silt loam, over clay, strongly saline-alkali.
Sonoma silty clay loam, strongly saline-alkali.
Toy silty clay, strongly saline-alkali.
Toy silty clay loam, strongly saline-alkali.

Habitat limitations: Moderate for native shrubs; severe for grain crops, for grasses and legumes, and for shallow-water impoundments; very severe for deep-water impoundments.

Suitability: Good for rangeland wildlife; poor for upland wildlife and for migratory wetland wildlife; not suitable for nonmigratory wetland wildlife.

WILDLIFE SITE 8

The soils in this wildlife site are—

Humboldt silt loam, moderately coarse substratum, strongly saline-alkali.
Humboldt silt loam, drained, strongly saline-alkali.
Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes.

Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes.
Placeritos loam, strongly saline-alkali.
Placeritos loam, drained, strongly saline-alkali.
Placeritos loam, over sand, strongly saline-alkali.
Placeritos loam, terrace, strongly saline-alkali.

Habitat limitations: Moderate for native shrubs; severe for grain crops and for grasses and legumes; very severe for shallow-water impoundments and for deep-water impoundments.

Suitability: Good for rangeland wildlife; poor for upland wildlife; not suitable for migratory wetland wildlife and for nonmigratory wetland wildlife.

WILDLIFE SITE 9

The only soil in this wildlife site is Quincy fine sand, 0 to 15 percent slopes.

Habitat limitations: Moderate for native shrubs; very severe for grain crops, for grasses and legumes, for shallow-water impoundments, and for deep-water impoundments.

Suitability: Good for rangeland wildlife; not suitable for upland wildlife, for migratory wetland wildlife, and for nonmigratory wetland wildlife.

WILDLIFE SITE 10

The soils in this wildlife site are—

Kodak loamy fine sand, moderately deep.
Lovelock silt loam, strongly saline.
Lovelock silt loam, occasionally flooded, strongly saline.
Lovelock silt loam, overwashed, strongly saline.
Lovelock silt loam, shallow over clay, strongly saline.

Habitat limitations: Moderate for shallow-water impoundments; severe for native shrubs and for deep-water impoundments; very severe for grain crops and for grasses and legumes.

Suitability: Good for migratory wetland wildlife; poor for nonmigratory wetland wildlife; not suitable for upland wildlife and for rangeland wildlife.

WILDLIFE SITE 11

Only Sandy alluvial land is in this wildlife site.

Habitat limitations: Severe for native shrubs, for shallow-water impoundments, and for deep-water impoundments; very severe for grain crops and for grasses and legumes.

Suitability: Poor for rangeland wildlife, for migratory wetland wildlife, and for nonmigratory wetland wildlife; not suitable for upland wildlife.

WILDLIFE SITE 12

The soils in this wildlife site are—

Bluewing gravelly fine sandy loam, 2 to 8 percent slopes.
Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes.
Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes.
Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes.
Toulon very gravelly loam, 0 to 4 percent slopes.
Unionville very rocky coarse sandy loam, 4 to 8 percent slopes.
Woolsey gravelly fine sandy loam, 2 to 8 percent slopes.

Habitat limitations: Severe for native shrubs; very severe for grain crops, for grasses and legumes, for shallow-water impoundments, and for deep-water impoundments.

Suitability: Poor for rangeland wildlife; not suitable for upland wildlife, for migratory wetland wildlife, and for nonmigratory wetland wildlife.

Formation and Classification of Soils

In this section, the factors that influenced soil formation are discussed and the soils are classified in higher categories.

Soil Formation

Soil is a natural body on the surface of the earth in which plants grow. It is a mixture of rocks and minerals, organic matter, water, and air, all of which occur in varying proportions. The rocks and minerals are fragmented and partly or wholly weathered. Soils have more or less distinctive layers, or horizons, that are the product of environmental forces acting upon materials deposited or accumulated by geological agencies.

The characteristics of the soil at any given point are determined by the interaction of (1) the parent material; (2) the climate in which the soil material has accumulated and has existed since accumulation; (3) the relief, or topography, which influences the local, or internal, environment of the soil, its drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind; (4) the biological forces that act upon the soil material—the plants and animals living on and in it; and (5) the length of time the climatic and biological forces have acted on the soil material.

Parent material

The soil materials are mainly those on the flood plain and delta of the Humboldt River, on lacustrine terraces and alluvial fans along the sides of the valley, and in the foothills. The material of the foothills was derived from granodiorite. In several areas sand dunes and other eolian deposits are superimposed on the flood plain and delta and on terraces.

All the soil materials of the flood plain and delta were derived from many kinds of igneous, sedimentary, and metamorphic rocks and from sediments that occurred mostly outside of the valley. The most important of these include granodiorite, andesite, basalt, rhyolite, tuff, slate, and limestone, as well as lacustrine clay, silt, and sand.

These soil materials have high cation-exchange capacity, and they contain clays that are dominantly of a 2-to-1 lattice type. Because the parent material includes rhyolite, andesite, basalt, and tuff, the soils possibly contain noncrystalline minerals that are high in exchange capacity. All of the soils have more than 2 milliequivalents of exchangeable potassium per 100 grams of soil. The relatively high content of exchangeable potassium indicates the occurrence of volcanic glass and other noncrystalline or amorphous minerals of variable composition.

Soil materials of the flood plain were recently deposited during short periods of aggradation and degradation when the Humboldt River was relatively unstable. The soil materials were dominantly loamy, but some clayey material was deposited near the mouth of the river. The Ocala, Placeritos, and Sonoma soils formed in loamy material, and the Lahontan soils formed in clayey material. Except for texture, differences due to parent material are generally lacking in soils on the flood plain.

Soil materials in the delta were recently deposited by the Humboldt River. Formed in these materials, which are dominantly clayey, were the Humboldt, Lovelock, Rye-

patch, and Toy soils. Of these, the Lovelock soils show the strongest influence of parent material. Lovelock soils contain a large amount of diatomaceous earth and shells from fresh-water mollusks. Their low bulk density is directly related to the high content of diatomaceous earth. The high content of calcium carbonate, or its equivalent, is due to the large quantity of mollusk shells.

Soil materials in terraces and alluvial fans came mostly from outside the valley and were derived from many kinds of igneous, sedimentary, and metamorphic rocks. These materials were transported from sources much closer to the Area than those on the flood plain and delta. As a result, they are coarser textured. Much of their calcium carbonate is supplied from tufa, a calcareous rock formed as a deposit in shallow water.

The material that forms terraces was deposited in Quaternary Lake Lahontan (*8*) and consists of stratified, poorly graded sand and gravel. The Toulon soils formed in this material.

Soil materials of the alluvial fans vary in age, texture, and other characteristics, depending on their source. In some places the material was deposited recently, and in others it is relatively old. Short alluvial fans that extend below offshore lake bars were laid down recently and are very gravelly and sandy. The Bluewing soils formed in these deposits. Recent alluvial fans derived from finer textured material consist of loamy alluvium in which the Mazuma soils formed. Older alluvial fans are made up of stratified, gravelly and loamy materials that developed into the Woolsey soils.

The Unionville soils formed in residuum weathered from granodiorite. Calcium carbonate is readily supplied to these soils by the tufa that coats many of the outcrops and boulders of granodiorite. Unionville soils are extraordinary because they contain a large amount of coarse and very coarse grains of quartz and unweathered feldspar.

Eolian, or wind-deposited, soil material is either sandy or loamy. Quincy soils formed in sandy material that is dominantly fine quartz sand. Kodak soils formed in loamy material that was blown from Lovelock soils and from deposits on beaches, near the edge of marshes and lakes, and along streams. Most of the sand in the Kodak soils consists of shell fragments from small mollusks.

Climate

The climate of the Area is arid and is representative of that of western Nevada. Winters are cold and summers are warm. Precipitation averages about 6 inches annually and comes mostly in winter. The average temperature in January is 29° F., and in July it is 75°. The average annual temperature is 52°. Daily ranges in temperature are wide; the average range is 25° in winter and 38° in summer. The average frost-free season is 120 to 135 days.

During the Pleistocene epoch, the Lahontan Basin, which includes Lovelock Valley, had a climate that probably differed little from that of today (*5*). Climatic fluctuations occurred but were only slight. Then, as now, there were series of dry, normal, and wet years, but the total amount of precipitation in any one year was low.

In 1952 precipitation in the valleys of Lahontan Basin was approximately normal, but in the upper watersheds, it exceeded normal by 50 to 100 percent. As a result, Pyramid Lake rose about 7 feet, and Humboldt Lake rose about 6 feet, doubled in area, and spilled into Carson Sink. This suggests that Lake Lahontan was formed when precipitation in the watersheds was much above normal for several years in a row. A series of similarly wet years might cause the lake to form again.

Except for soils on the flood plain and delta, all soils in the Area contain only a small amount of organic matter in the A horizon. The content of organic matter is low because rainfall is light, periods of sunshine are long, the temperature and rate of evaporation in summer are high and, consequently, the stand of native plants is sparse. On the other hand, soils that formed in the delta and flood plain were densely covered by plants that obtained most of their moisture from ground water rather than rainfall. These soils have a considerably higher content of organic matter.

In the Bluewing, Toulon, Unionville, and Woolsey soils, soil forming was sped by the high summer temperatures, but it was slowed by scanty rainfall. High temperatures encourage the rapid weathering of soil materials. In general, the speed of chemical reaction doubles for each rise of 10° C. in temperature. Where the climate is dry, however, the rate of weathering slows because water is the medium in which reactions take place. Water is a major source of hydrogen ions, a principal agent of weathering, and by carrying away the end products of chemical reactions, water allows the reactions to continue. If the depth of moisture penetration is limited, leaching also is limited, the end products accumulate, and weathering is slowed down or may be temporarily stopped.

Relief and drainage

The valley of the Humboldt River, locally called Lovelock Valley, is in the Great Basin section of the Basin and Range province (*3*). It resembles other valleys of the province in most respects and consists of a low-lying basin that is filled with alluvium and is surrounded by sharp, rugged, essentially parallel mountain ranges of complex structure. It has a general north-south trend and drains into Carson Sink through a natural opening in Humboldt Bar, a gravel embankment formed in ancient Lake Lahontan.

The valley is bounded on the west by the Trinity Range, which rises to an elevation of about 7,000 feet above sea level. In the mountains that bound the valley on the east, the highest points are 5,600 feet in the West Humboldt Range and 8,900 feet in the Humboldt Range. These mountains are not a part of the survey area. Elevations in the Area range from slightly less than 4,040 feet at the northern end to less than 3,900 feet at Humboldt Lake.

All of Lovelock Valley is below the highest shoreline of Lake Lahontan, a prehistoric lake of the Quaternary period that greatly influenced the soils of the valley. A remnant of that lake is Humboldt Lake.

The valley consists of four distinct topographic features: steep mountain slopes, lacustrine terraces, alluvial fans, and the delta and flood plain. Minor topographic features include scattered sand dunes and obscure foothills.

The Humboldt River, the only perennial stream flowing into the valley, terminates in Humboldt Lake. The flow of the river is normally heavy late in winter and early in spring, but it drops off rapidly in summer. In years of light runoff, the lower part of the river carries no water, and the lake may become completely dry.

On the eastern and the western sides of the valley, the most prominent features are lacustrine terraces. These terraces were deposited as offshore bars in Lake Lahontan; on aerial photographs they resemble concentric steps. They have steep sides and nearly level tops and consist of strata of poorly graded sand and well-rounded, poorly graded gravel. Toulon soils have developed in these deposits and are excessively drained.

Because the foothills have been obscured by offshore bars, they are no longer prominent. On these foothills Unionville soils formed in weathered material and are well drained.

Below the lacustrine terraces and bars there are short alluvial fans that are smooth or gently convex and nearly level to moderately sloping. They are dissected by many shallow channels and a few broad, deep ones. On these alluvial fans Bluewing, Mazuma, and Woolsey soils developed. These soils are well drained to excessively drained. Runoff from higher lying soils is still depositing sediments on the Bluewing and Mazuma soils and washing away material.

The flood plain and the delta are broad and essentially flat. They consist almost entirely of material laid down by the Humboldt River; little material came from alluvial fans. The material was deposited along the river during floods, or it settled in shallow lakes.

Soils on the flood plain are next to channels and meanders of the Humboldt River through the Lovelock Valley. They are the light-colored, silty and clayey Lahontan, Ocala, Placeritos, and Sonoma soils. Their drainage ranges from moderately good to poor. The moderately well drained soils occur near places where the river has formed a deep, permanent channel. The poorly drained soils are adjacent to shallower reaches of the river.

Soils on the delta are dark colored and are high in organic-matter content. They include the Humboldt, Lovelock, Ryepatch, and Toy soils. These soils are imperfectly drained or poorly drained, but they developed under considerably poorer drainage, probably poor or very poor.

The river cut only a shallow channel through these soils as they developed. In spring a heavy flow of water easily filled the channel and then spread out over the adjacent soils in an almost continuous sheet. The water flowing over the surface eventually entered Humboldt Lake, but the soils remained at least partly saturated throughout the year. Because they lie adjacent to Humboldt Lake, the Lovelock soils were probably under water most of the time.

The colors of soils are strongly influenced by iron—a constituent of many minerals that is largely responsible for the bright colors in soils. Iron generally occurs in the ferric form and in this form is insoluble if air is present. But in soils containing large amounts of organic matter and water, iron is reduced to ferrous forms that are soluble and move readily in water. This change, called reduction, takes place in soils on the flood plain and delta. Ferrous iron goes into solution and is removed from the soil in drainage water. As a result, the colors of these soils are materially affected. They have (1) chromas of less than 2; (2) hues of neutral, yellow (2.5Y or 5Y), or greenish yellow (5GY); or both such chromas and hues. Soils that have yellowish hues are sometimes referred to as gleyed. Intense gleying generally takes place in soils that are poorly drained.

Thus, the color of soils commonly indicates the degree of drainage that existed while the soils were forming. For example, the Sonoma soils, when either moist or dry, have a hue of 10YR and a chroma of 1 or 2. They are imperfectly drained and probably formed under imperfect drainage. The Lovelock soils, either moist or dry, have a hue of 5Y or neutral and a chroma of 1 or 0 and probably formed under very poor drainage, though they are now poorly drained or imperfectly drained.

In soils that have a fluctuating water table, iron is also reduced but is not removed in drainage water. When the water table falls, aeration improves, the content of oxygen increases, and the ferrous iron in solution is oxidized and precipitated as ferric oxide. Ferric oxide is reddish and spots the soil with mottles in the places where it is precipitated. The Lahontan, Placeritos, and Sonoma soils are mottled at some depth in their profile.

Nearly all the soils on the flood plain and delta have been strongly affected by salts and alkali. The water table is shallow in these soils, and the ground water has a high content of salts. Excessive salts and alkali accumulated, generally on or near the surface, when the saline ground water rose through capillary action and evaporated. Such plants as greasewood and shadscale, through their normal activity, also added salts to the soil.

The weakly cemented silica hardpan in the Ocala soils of the flood plain developed as a result of strong alkalinity caused by a soil solution that was high in content of sodium. The silica in Ocala soils was supplied by tuff, volcanic ash, and other siliceous rocks. It is soluble at a high pH. The pH rose to more than 10 after the soluble salts were leached from the surface layer and the sodium became dominant. Because of this high pH, the silica went into solution and moved downward to the water table, where soluble salts were dominant and the pH was lower than in the surface layer. Because of the lower pH, the silica precipitated out of solution and gradually a Csi horizon, or hardpan, was formed.

Biological activity

On the alluvial fans and in the foothills, the native plants are desert shrubs and grasses. Because the soils are well drained to excessively drained and are dry for long periods, these plants cover only about 5 percent of the surface. They add little organic matter to the soil, give scant protection from water and wind, and provide meager shade. For this reason, the soils are poor habitats for micro-organisms.

On the flood plain, where the water table is generally high, the vegetation is a lush growth of phreatophytes, or deep-rooted plants that obtain their moisture from ground water or the layer of soil just above it. These plants cover 0 to 20 percent of the surface, depending on the content of salts and alkali in the soil. In most places they furnish a large amount of organic matter, protect the soils from erosion, and provide adequate shade. The content of organic matter ranges from about 0.6 percent in soils that have a relatively large accumulation of salts and alkali to about 3.0 percent in soils that have a small accumula-

tion. Soils that are strongly saline-alkali provide a poor habitat for micro-organisms.

On the delta the vegetation consists of water-loving grasses and other aquatic plants. While the soils were forming, drainage was poor or very poor, water was readily available, and the native plants grew abundantly. Consequently, soils on the delta are the darkest in the valley. Most of them have an organic-matter content of 5 to 10 percent. In the Lovelock soils, a permanently high water table inhibited the growth of aerobic micro-organisms and, as a result, the content of organic matter is 10 to 20 percent. Because the bacteria needed to oxidize organic matter are insufficient, Lovelock soils have a carbon-nitrogen ratio of more than 15:1.

As the Humboldt River cut its channel, and after water was diverted from the river for irrigation, drainage on the delta improved, but excessive salts and alkali accumulated in the soils. The original plant cover was replaced by greasewood, or by saltbush and an understory of saltgrass, or by saltgrass alone. From 0 to 25 percent of the surface is now covered by these plants, depending on the salt and alkali content. Because the soils are affected by excess salts and alkali, they provide a poor habitat for micro-organisms.

Time

The soils in the survey area are of different ages. The time available for a soil to develop in unconsolidated sediments is the time that has elapsed since the last sediments were laid down. Soils on igneous rocks began to develop after the parent rocks weathered into permeable material.

In general, the flood plain and delta consist of the most recent alluvium, and the lacustrine terraces are composed of the oldest. Soil material in the alluvial fans and foothills ranges from young to intermediate in age.

Soils on the delta and flood plain have little or no profile development other than the formation of an A1 horizon. Soils on the alluvial fans and in the foothills vary in degree of development. All have a thin A1 horizon, but in the Mazuma soils, the youngest, no other horizons have formed. The Bluewing soils are of intermediate age and have a weak Cca horizon where calcium carbonate has accumulated. Woolsey soils, the oldest, have a thin, weak textural B2 horizon and, in some places, a Cca horizon. They are moderately alkaline and have a base saturation percentage of 100.

The material in lacustrine terraces has been in place the longest, and from it developed the Toulon soils. These soils have a thin A1 horizon, a weak color B horizon, and an accumulation of lime in the C horizon. They have an erosion pavement of gravel that covers almost 98 percent of the surface. Most of the pebbles are coated on their upper side with a burnished desert varnish of oxidized iron and manganese. In places soil material from lacustrine terraces was washed downslope and deposited as alluvial fans, in which younger soils developed.

Because the Toulon soils contain a large amount of gravel and coarse sand, no textural B2 horizon is visible. Most of the pebbles are stained by iron oxide that was formed during a long period in this area of low rainfall. The available iron was concentrated on the surface of the pebbles as a result of occasional wetting followed by reduction, oxidation, and precipitation. Mottles form in a similar way in soils that are more poorly drained.

Classification of Soils

In the system of soil classification followed in the United States since 1938 (*12*), soils are classified in six categories. These are the order, suborder, great soil group, family, series, and type. This system, with later modifications, has been followed in placing the soils of the Area in orders and great soil groups. The modifications are those suggested by Thorp and Smith (*9*).

Table 10 shows the orders and great soil groups represented in the Lovelock Area. It lists the soil series in each great soil group and gives pertinent information about the soils. All three soil orders—azonal, intrazonal, and zonal—are represented in the survey area.

Azonal soils

Azonal soils lack distinct, genetically related horizons because of their youth, resistant parent material, or steep topography (*2*). In the Lovelock Area the azonal soils have been classified by great soil groups as Alluvial soils and Regosols.

ALLUVIAL SOILS

Alluvial soils are youthful soils that have developed in alluvium transported and deposited recently. This alluvium has been modified little or none by soil-forming processes. In the Lovelock Area, the Alluvial soils are in the Bluewing, Mazuma, Lahontan, Ocala, Placeritos, and Sonoma series.

The Bluewing and Mazuma soils occur on alluvial fans. These soils are excessively drained, very gravelly, and coarse textured or are well drained and moderately coarse textured. Because a small amount of organic matter has accumulated, a weak A1 horizon has formed, though it is obscured by erosion or deposition in some places. In some of the soils, enough lime has accumulated to form a weak Cca horizon.

Bluewing series: This series consists of excessively drained, very gravelly, coarse-textured soils that have formed in alluvium washed mostly from dark-colored chert and quartzite and lighter colored granodiorite, and partly from basalt, rhyolite, tufa, and slate. These soils are nearly level to moderately sloping and occur in coarse-textured deposits on slightly convex alluvial fans that protrude from bars, terraces, and other areas along the shoreline of ancient Lake Lahontan. They have a very thin A1 horizon and a weak Cca horizon that contain less than 15 percent calcium carbonate or its equivalent.

Representative profile (Bluewing gravelly fine sandy loam, 2 to 8 percent slopes, in an undisturbed area 220 feet east and 440 feet south of the north quarter corner of sec. 17, T. 27 N., R. 31 E., Mount Diablo base line and meridian):

A1—0 to 1 inch, light brownish-gray (2.5Y 6/2) gravelly fine sandy loam, very dark grayish brown (2.5Y 3/2) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few, very fine roots; few, fine and common, very fine vesicles and many, very fine pores; very strongly calcareous; pH at 1 to 5 dilution is 8.8; abrupt, wavy boundary; horizon 1 to 2 inches thick.

TABLE 10.—*Soil series classified in orders and*

AZONAL SOILS

Great soil group and series	Parent material	Relief and drainage
Alluvial soils:		
Bluewing	Sandy and gravelly alluvium from quartzite, granodiorite, limestone, slate, and basic igneous rocks.	Plane or gently convex, nearly level to moderately sloping alluvial fans; excessively drained.
Mazuma	Loamy alluvium from basalt, rhyolite, tuff, limestone, and reworked lacustrine sediments.	Smooth or slightly undulating, nearly level to moderately sloping alluvial fans; well drained.
Lahontan	Clayey alluvium from mixed igneous and sedimentary rocks.	Smooth ,nearly level flood plains; imperfectly drained.
Ocala	Loamy alluvium from limestone, basalt, tuff, and reworked lacustrine sediments.	Smooth, nearly level flood plains; poorly drained
Placeritos	Loamy alluvium from limestone, tuff, basalt, and reworked lacustrine sediments.	Smooth, nearly level flood plains; imperfectly drained.
Sonoma	Loamy alluvium from limestone, basalt, tuff, and reworked lacustrine sediments.	Smooth, nearly level flood plains; imperfectly drained.
Regosols:		
Kodak	Loamy eolian material from adjacent Lovelock soils and from beach, marsh, and lake deposits.	Broad, low, nearly level hummocks superimposed on deltaic flood plains; imperfectly drained.
Unionville	Residuum from granodiorite, strongly influenced by tufa.	Gently rolling foothills; well drained
Quincy	Sandy eolian deposits from adjacent soils and lacustrine sediments.	High, broad, nearly level to strongly sloping areas of dunes; excessively drained.

INTRAZONAL SOILS

Great soil group and series	Parent material	Relief and drainage
Humic Gley soils:		
Humboldt	Somewhat stratified loamy and clayey alluvium from limestone, basalt, tuff, and reworked lacustrine deposits.	Smooth, nearly level deltaic flood plains; poorly drained.[1]
Lovelock	Alluvium high in diatomaceous earth and volcanic glass, derived from limestone, basalt, tuff, and reworked lacustrine deposits.	Smooth, nearly level deltaic flood plains; low, broad hummocks in some areas; poorly and very poorly drained.[1]
Ryepatch	Clayey alluvium from limestone, tuff, basalt, and reworked lacustrine deposits.	Smooth, nearly level deltaic flood plains; poorly drained.[1]
Solonetz soils:		
Toy	Clayey alluvium from limestone, tuff, basalt, andesite, and reworked lacustrine deposits.	Smooth, nearly level deltaic flood plains; poorly drained.[1]

ZONAL SOILS

Great soil group and series	Parent material	Relief and drainage
Desert soils:		
Toulon	Gravelly alluvium from dark-colored chert, slate, quartzite, granodiorite, tufa, and basalt.	Mainly the tops but partly the sides of smooth, nearly level or gently sloping terraces; excessively drained.
Woolsey	Loamy, somewhat gravelly alluvium derived from a wide variety of igneous and sedimentary rocks and from lacustrine sediments.	Smooth, gently sloping and moderately sloping alluvial fans; somewhat excessively drained.

[1] Drainage while the soils were forming, not present drainage.

great soil groups and some factors of soil formation

Native vegetation	Genetic horizons	Development of B horizon
AZONAL SOILS—Continued		
Shadscale, upland greasewood, bud sagebrush, and halogeton; plant density 1 to 5 percent.	None	None.
Upland greasewood, shadscale, and suaeda, with a density of 10 to 15 percent; or, in areas free of salts and alkali, shadscale, greasewood, bud sagebrush, and halogeton, with a plant density of 2 to 5 percent.	None	None.
Greasewood, saltgrass, and suaeda; plant density 0 to 5 percent.	None	None.
Saltgrass, and some upland greasewood and suaeda; plant density 0 to 20 percent.	Weakly cemented hardpan, soluble in strong alkali	None.
Dominantly upland greasewood, saltgrass, and four-wing saltbush; plant density 10 to 20 percent.	None	None.
Greasewood, saltgrass, and saltbush; plant density 10 to 20 percent.	Weak A1 horizon	None.
Heliotrope and suaeda; plant density 10 to 20 percent	None	None.
Shadscale, upland greasewood, bud sagebrush, and halogeton; plant density 2 to 10 percent.	Weak A1 horizon and weak Cca horizon	None.
Greasewood, dahlia, shadscale, and Indian ricegrass; plant density 5 to 15 percent.	None	None.
INTRAZONAL SOILS—Continued		
Meadow grasses, sedges, rushes, and saltgrass; plant density 20 to 60 percent.[2]	A dark-colored A1 horizon and a Cg horizon	None.
Tules, rushes, and sedges; plant density 40 to 70 percent [2]	A dark-colored A1 horizon and a Cg horizon	None.
Meadow grasses, sedges, rushes, and saltgrass; plant density 20 to 60 percent.[2]	A dark-colored A1 horizon and a Cg horizon	None.
Saltgrass, greasewood, bassia, and inkweed; plant density 2 to 10 percent.	A dark-colored A1 horizon, a solonetzic B2 horizon, and a Cg horizon.	Weak.
ZONAL SOILS—Continued		
Almost barren; a few stunted plants of greasewood, shadscale, bud sagebrush, and halogeton.	Weak A1 horizon and colored B2 horizon	Weak.
Shadscale, upland greasewood, and halogeton; plant density 2 to 10 percent.	Weak A1 horizon and weak textural B2 horizon	Weak.

[2] Vegetation while the soils were forming, not present vegetation.

C1—1 to 25 inches, light brownish-gray (2.5Y 6/2) very gravelly loamy coarse sand, dark grayish brown (2.5Y 4/2) when moist; massive in place, breaking to single grain when displaced; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant, very fine and few, fine roots; many, very fine and fine and few, medium pores; very strongly calcareous; a few pebbles have a thin, light-gray (2.5Y 7/2) coating of lime on their under sides; pH at 1 to 5 dilution is 8.6; gradual, wavy boundary; horizon 16 to 28 inches thick.

C2ca—25 to 48 inches, light brownish-gray (2.5Y 6/2) very gravelly loamy coarse sand, grayish brown (2.5Y 5/2) when moist; massive in place, breaking to single grain when displaced; slightly hard or soft when dry, very friable when moist, nonsticky and nonplastic when wet; few, very fine and fine roots; many, very fine and fine pores; very strongly calcareous; about 75 percent of the pebbles have a thin, light-gray (2.5Y 7/2) coating of lime on their under sides; pH at 1 to 5 dilution is 9.0; gradual, smooth boundary; horizon 15 to 24 inches thick.

C3—48 to 59 inches +, light brownish-gray (2.5Y 6/2) very gravelly coarse sand, grayish brown (2.5Y 5/2) when moist; massive in place, breaking to single grain when displaced; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few, very fine and fine roots; many, very fine and fine pores; very strongly calcareous; a few pebbles have a thin, light-gray (2.5Y 7/2) lime coating on their under sides; pH at 1 to 5 dilution is 8.8.

Mazuma series: The Mazuma series consists of well-drained, moderately coarse textured soils that are on plane or very gently convex, nearly level to moderately sloping alluvial fans (fig. 13) under a cover of greasewood. The parent material was derived from rhyolite, tuff, basalt, granodiorite, and other rocks and from unconsolidated lake sediments. These soils contain less than 3 percent calcium carbonate or its equivalent.

Representative profile (Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes, in an undisturbed area 260 feet east and 100 feet north of the southwest corner of sec. 9, T. 27 N., R. 31 E., Mount Diablo base line and meridian):

A11—0 to 1½ inches, very pale brown (10YR 7/3) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few, fine roots; many, fine and medium vesicular pores; slightly calcareous; pH at 1 to 5 dilution is 8.8; abrupt, smooth boundary; horizon ½ to 4 inches thick.

A12—1½ to 8 inches, light brownish-gray (10YR 6/2) fine sandy loam or loam, dark grayish brown (10YR 4/2) when moist; very weak, thin, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few, fine roots; few, very fine and fine tubular pores; slightly calcareous; a few spots strongly calcareous; pH at 1 to 5 dilution is 9.0; clear, smooth boundary; horizon 4 to 10 inches thick.

C1—8 to 12 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few, fine roots; common, fine tubular pores; slightly calcareous but strongly calcareous where a few, fine, distinct, very pale brown (10YR 7/3) lime mottles occur; pH at 1 to 5 dilution is 9.2; clear, smooth boundary; horizon 4 to 8 inches thick.

C2—12 to 23 inches, very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; few, fine roots; common, very fine tubular pores; strongly calcareous; pH at 1 to 5 dilution is 8.6; abrupt, smooth boundary; horizon 8 to 16 inches thick.

C3—23 to 30 inches, very pale brown (10YR 7/3) stratified fine sandy loam and sandy loam that contain a few pebbles, brown (10YR 5/3) when moist; very weak, coarse or medium, subangular blocky structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few, fine roots; few, very fine tubular pores; strongly calcareous; pH at 1 to 5 dilution is 8.8; abrupt, smooth boundary; horizon 6 to 12 inches thick.

IIC4—30 to 39 inches, pale-brown (10YR 6/3) gravelly very coarse sand, dark brown (10YR 4/3) when moist; single grain; loose when dry and when moist; few, very fine roots; porous; generally noncalcareous but slightly calcareous in spots; pH at 1 to 5 dilution is 8.8; abrupt, smooth boundary; horizon 0 to 16 inches thick.

IIIC5—39 to 60 inches +, pale-brown (10YR 6/3) micaceous very fine sandy loam, dark brown (10YR 4/3) when moist; weak, medium or thin, platy structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few, very fine roots; few, fine tubular pores; strongly calcareous; pH at 1 to 5 dilution is 8.6.

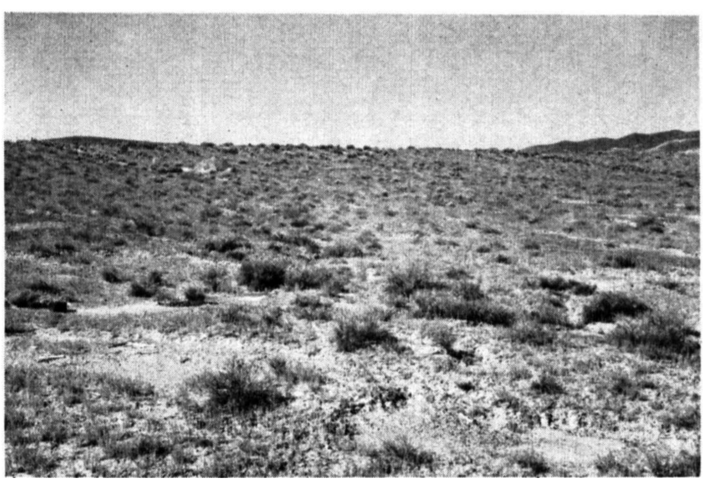

Figure 13.—Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes, on alluvial fan, in foreground; Toulon very gravelly loam, 0 to 4 percent slopes, on lacustrine terraces, in background.

The Lahontan, Ocala, Placeritos, and Sonoma soils are Alluvial soils that occur on flood plains. These soils generally are finer textured than those on alluvial fans. They are medium-textured to fine-textured soils that are imperfectly drained to poorly drained and, in undisturbed areas, are strongly saline-alkali. A moderate or slight accumulation of organic matter has formed a weak A1 horizon. In most of the soils, transfers of iron have resulted in mottling, and lime precipitated from ground water has formed concretions in the substratum.

Lahontan series: In the Lahontan series are deep, moderately well drained, fine-textured soils that are nearly level and occur on flood plains, deltas, and low-lying terraces. While these soils were developing, the surface was nearly barren; generally less than 5 percent is now covered by plants, chiefly greasewood or saltgrass. The parent material is clayey and was derived from many kinds of igneous, metamorphic, and sedimentary rocks. The A1 horizon has about 1 percent organic matter. Iron mottles occur in the C horizon. In the Lovelock Area, these soils contain strong concentrations of salts and alkali.

Representative profile (Lahontan silty clay loam, strongly saline-alkali, located about 750 feet north and 200

feet west of the east quarter corner of sec. 30, T. 17 N., R. 29 E., Mount Diablo base line and meridian) :

Ap—0 to 4 inches, light brownish-gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; very weak, coarse and medium, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; abundant, fine roots; few, very fine and fine tubular pores; the surfaces is cracked in a polygonal pattern; slightly calcareous; pH at 1 to 5 dilution is 9.4.

C1—4 to 20 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, medium, subangular and angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; a few, very fine roots; few, very fine and fine tubular pores; slightly calcareous; pH at 1 to 5 dilution is 9.0.

C2—20 to 38 inches, light-gray (2.5Y 7/2) clay, grayish brown (2.5Y 5/2) when moist; few, fine, faint, dark-brown (7.5YR 4/4) iron mottles coating the pores; massive; very hard when dry, very firm when moist, very sticky and very plastic when wet; few, very fine roots; very few, very fine tubular pores; strongly calcareous; pH at 1 to 5 dilution is 8.4.

C3—38 to 63 inches +, similar to C2 horizon in color, texture, structure, consistence, and reaction; essentially devoid of plant roots; no visible tubular pores; few, fine or medium, faint, dark-brown (7.5YR 4/4) mottles that increase to common with depth; pH at 1 to 5 dilution is 8.4.

Ocala series: In the Ocala series are moderately fine textured, poorly drained, saline-alkali soils that developed in loamy alluvium derived from mixed rocks, including limestone, basalt, and tuff, and from reworked lacustrine sediments. These soils are on the smooth, nearly level flood plain under a stand of saltgrass. Strong concentrations of salts and alkali have curbed the formation of iron mottles and of gleyed horizons. A weakly cemented Csi horizon has been formed by the transfer of siliceous material.

Representative profile (Ocala loam, strongly saline-alkali, in an undisturbed area about 790 feet west and 350 feet south of the east quarter corner of sec. 2, T. 25 N., R. 31 E., Mount Diablo base line and meridian) :

C1—0 to 10 inches, light-gray (5Y 7/2) loam that has a few, thin lenses of fine sandy loam, olive (5Y 5/3) when moist; moderate, thick, platy structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant, very fine and fine roots and abundant rhizomes; few, very fine and fine tubular pores; strongly calcareous; pH at 1 to 5 dilution is 9.0; clear, smooth boundary.

C2—10 to 14 inches, light-gray (5Y 7/2) silty clay loam, olive gray (5Y 4/2) when moist; strong, fine, angular and subangular blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; abundant, very fine and fine roots but less than in the C1 horizon; few, very fine and fine tubular pores; few, thin clay films in pores; strongly calcareous; pH at 1 to 5 dilution is 8.8; clear, smooth boundary.

C3si—14 to 26 inches +, light-gray (2.5Y 7/2) light silty clay loam, dark grayish brown (2.5Y 4/2) when moist; massive; contains weakly cemented fragments of alkali-soluble hardpan; hard to very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few, very fine and fine roots; many, very fine tubular pores; strongly calcareous; pH at 1 to 5 dilution is 8.6.

Placeritos series: The Placeritos series consists of very deep, imperfectly drained, medium-textured soils that occupy nearly level flood plains and alluvial fans. Most of the plant cover is salt- and alkali-tolerant shrubs. The parent material is calcareous; it was deposited by the Humboldt River and was derived from many kinds of igneous, metamorphic, and sedimentary rocks and from reworked lacustrine deposits. In the A1 horizon, the organic-matter content is more than 1.5 percent. Iron mottles occur in the C horizon.

Representative profile (Placeritos loam, about 30 feet west and 30 feet north of the SE. corner of sec. 23, T. 27 N., R. 31 E., Mount Diablo base line and meridian) :

Ap—0 to 6 inches, loam, very dark grayish brown (10YR 3/2) when moist; massive to weak, medium and fine, subangular blocky and weak, medium and fine, granular structure; sticky and slightly plastic when wet, friable when moist, slightly hard when dry; many, fine roots and a few, coarse fibrous roots; worm casts are common; pH 8.0 (saturated paste) ; moderately calcareous; abrupt, smooth boundary.

C1—6 to 13 inches, silt loam, dark grayish brown (2.5Y 4/2) when moist; many, fine, faint to distinct, dark-brown (10YR 3/3) iron stains along root channels; fine, faint, dark-brown (10YR 3/3) mottles of iron are common; massive to very weak, fine, subangular blocky or fine, granular structure; slightly sticky when wet, friable when moist, slightly hard when dry; fine roots are common, a few, coarse fibrous roots; few worm casts; pH 8.2 (saturated paste) ; moderately calcareous; abrupt, wavy boundary.

C2—13 to 20 inches, loam, dark grayish brown (2.5Y 4/2) when moist; many, fine, dark-brown (7.5YR 3/2) and dark reddish-brown (5YR 3/3) stains and mottles along old root channels; massive to very weak, fine, subangular blocky and fine, granular structure; slightly sticky and nonplastic when wet, very friable when moist, soft to slightly hard when dry; fine and medium roots are common; few, coarse fibrous roots; few worm casts; fine and medium plates of mica common; pH 7.9 (saturated paste) ; moderately calcareous; clear, wavy boundary.

IIC3—20 to 26 inches, silty clay, very dark gray (10YR 3/1) when moist; fine, distinct, dark-brown (7.5YR 3/2) and common, dark reddish-brown (5YR 3/3) iron stains and mottles along old root channels; massive to weak, medium and fine, subangular blocky and fine, granular structure; sticky and plastic when wet, firm when moist, hard when dry; fine roots common; few, coarse fibrous roots; few, medium pores; pH 7.5 (saturated paste) ; slightly calcareous; clear, wavy boundary.

IIC4—26 to 35 inches, silty clay loam, very dark grayish brown (10YR 3/2) when moist; contains fingers of very dark gray (10YR 3/1) from horizon above and also light brownish-gray (10YR 6/2) lime seams; weak, medium, subangular blocky structure breaking to weak or moderate, medium, granular structure; very sticky and plastic when wet, friable when moist, slightly hard when dry; fine and medium fibrous roots are common; few, medium pores; pH 7.6 (saturated paste) ; slightly calcareous; clear, wavy boundary.

IIIC5—35 to 43 inches, silt loam, dark grayish brown (2.5Y 4/2) when moist; few fingers of very dark gray (10YR 3/1) silty clay loam; few, very fine, distinct, dark-brown (7.5YR 3/2) and dark reddish-brown (5YR 3/3) iron mottles in old root channels and in finely stratified bedding planes; massive; sticky and slightly plastic when wet, friable when moist, slightly hard when dry; fine roots are common; few, coarse fibrous roots; fine pores common; pH 7.9 (saturated paste) ; slightly calcareous; clear, smooth boundary.

IIIC6—43 to 60 inches, silt loam, dark grayish brown (2.5Y 4/2) when moist; very fine, distinct, dark reddish-brown (5YR 3/3) iron stains and mottles common; massive; slightly sticky when wet; friable when moist, slightly hard when dry; fine roots are common; few, medium fibrous roots; many, fine and very fine pores; few, thin, horizontal streaks of dark grayish-brown (10YR 4/2) very fine sandy loam; pH 7.9 (saturated paste) ; moderately calcareous.

Sonoma series: The Sonoma series consists of very deep, imperfectly drained, moderately fine textured soils that are on nearly level flood plains. Salt- and alkali-tolerant shrubs make up the cover of plants. The parent material, deposited by the Humboldt River, is calcareous and was derived from many kinds of igneous, metamorphic, and sedimentary rocks and from reworked lacustrine deposits. The A1 horizon has an organic-matter content of more than 3 percent. Iron mottles occur in the C horizon.

Representative profile (Sonoma silty clay loam in a cultivated area about 535 feet east and 165 feet south of the northwest corner of sec. 1, T. 26 N., R. 31 E., Mount Diablo base line and meridian):

Ap—0 to 8 inches, gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) when moist; weak or moderate, medium, subangular blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; abundant, very fine, fine, and medium roots; many, very fine and fine tubular pores and a few, medium tubular pores; strongly calcareous; pH 7.9 (saturated paste); clear, smooth boundary.

AC—8 to 13 inches, gray (10YR 6/1) silty clay loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, very sticky and plastic when wet; abundant, very fine and fine roots and a few, medium roots; many, fine and very fine tubular pores; many worm casts that are slightly darker in color than the soil matrix; strongly calcareous; pH 8.0 (saturated paste); clear, smooth boundary.

C1—13 to 21 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist, with a few, very fine, faint, yellowish-brown (10YR 5/4) iron mottles; very weak, coarse, prismatic structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant, very fine, plentiful, fine, and few, medium roots; few, fine and very fine tubular pores; few worm casts; strongly calcareous; pH 8.0 (saturated paste); clear, smooth boundary.

C2g—21 to 33 inches, light-gray (10YR 7/1) silty clay loam, gray (10YR 5/1) when moist; contains very dark grayish-brown pockets (2.5Y 3/2) and has common iron mottles that are very fine, faint, and dark brown (10YR 3/3); very weak, coarse and medium, subangular blocky structure; hard when dry, firm or friable when moist, very sticky and plastic when wet; abundant, very fine, plentiful, fine, and few, medium roots; many, fine and very fine tubular pores; strongly calcareous; pH 7.8 (saturated paste); abrupt, smooth boundary.

IIC3—33 to 46 inches, gray (10YR 6/1) silty clay, very dark gray (10YR 3/1) when moist; very weak, medium, subangular blocky structure; hard when dry, friable when moist, very sticky and very plastic when wet; plentiful, very fine and fine roots; many, very fine and fine tubular pores; moderately calcareous; pH 7.7 (saturated paste); abrupt, irregular boundary.

IIIC4—46 to 51 inches, gray (10YR 6/1) silt loam, dark gray to dark grayish brown (10YR 4/1–4/2) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful, very fine and few, fine roots; many, very fine and few, fine tubular pores; moderately calcareous; pH 7.8 (saturated paste); clear, irregular boundary.

IIIC5—51 to 55 inches, light-gray (10YR 7/2) light silty clay loam, brown (10YR 5/3) when moist; very weak, fine, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few, very fine and fine roots; common, very fine and fine tubular pores; few, very fine, firm nodules of lime; moderately calcareous; pH 7.8 (saturated paste); abrupt, wavy boundary.

IIIC6—55 to 65 inches +, light-gray (10YR 7/1) silty clay loam, gray (10YR 5/1) when moist; contains a few seams of iron that are fine, faint, and grayish brown (10YR 5/2) and a few mottles of iron that are very fine, faint, dark brown (7.5YR 4/4) and yellowish brown (10YR 5/4); moderate, very fine, subangular blocky structure; very hard when dry, friable when moist, very sticky and very plastic when wet; few, very fine roots; no pores observed; few, very fine, firm nodules of lime; moderately calcareous; pH 7.8 (saturated paste).

REGOSOLS

Regosols are youthful soils that developed in deep, unconsolidated deposits or in soft, rocky deposits. They have no definite genetic horizons.

The Regosols in the Lovelock Area are the Kodak, Quincy, and Unionville soils. The Kodak and Quincy soils formed in deep, eolian deposits that were deposited on the nearly level flood plain and delta. They are coarse textured and excessively drained or are moderately coarse textured and imperfectly drained. In some places small amounts of organic matter have accumulated to form a weak A1 horizon. Where the plant cover has been disturbed, there is erosion and deposition by wind.

The Unionville soils formed in residuum that was derived from granodiorite and was influenced by tufa. These soils occupy rolling foothills and are moderately deep, moderately coarse textured, and well drained. They have a weak A1 horizon, an upper C horizon that has weak structure, and a weak Cca horizon overlying granodiorite bedrock.

Kodak series: The Kodak series consists of imperfectly drained, stratified, medium-textured and moderately coarse textured soils that occur as broad, low, nearly level hummocks near the edge of Humboldt Lake. These soils developed in material blown from nearby Lovelock soils and from deposits on beaches, in marshes and lakes, and along streams. The material accumulated on Lovelock soils and is moderately deep or deep. Salt- and alkali-tolerant shrubs growing in sparse stands make up the vegetation. The A1 horizon is about 3 percent organic matter. Kodak soils are strongly affected by salts and alkali.

Representative profile (Kodak loamy fine sand, moderately deep, in an undisturbed area about 90 feet east and 620 feet south of the west quarter corner of sec. 35, T. 25 N., R. 30 E., Mount Diablo base line and meridian):

C1—0 to 4 inches, gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) when moist; weak, very thick, platy structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; abundant, fine roots; few, fine tubular pores; low bulk density; many, white fragments of mollusk shells; strongly calcareous; pH at 1 to 5 dilution is 9.2; abrupt, smooth boundary.

C2—4 to 9 inches, gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; abundant, fine roots; many, very fine pores; low bulk density; 10 to 15 percent white shells and fragments of shells from mollusks; strongly calcareous; pH at 1 to 5 dilution is 8.8; abrupt, smooth boundary.

IIC3—9 to 27 inches, similar to C2 horizon but is fine sandy loam; abrupt, smooth boundary.

IIC4—27 to 31 inches, gray (10YR 5/1) very fine sandy loam, dark gray (10YR 4/1) when moist; massive; slightly hard when dry, very friable when moist, nonsticky

and nonplastic when wet; abundant, very fine roots; low bulk density; common, white fragments of mollusk shells; strongly calcareous; pH at 1 to 5 dilution is 8.8; abrupt, smooth boundary.

IIIC5—31 to 60 inches, gray (N 6/0) silt loam, dark gray (N 4/0) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; plentiful, very fine roots; common, very fine tubular pores; very high in organic matter; low bulk density; common, fine, white fragments of mollusk shells; strongly calcareous; pH at 1 to 5 dilution is 8.6.

Unionville series: The Unionville series consists of moderately deep, moderately coarse textured, well-drained soils that developed in residuum from granodiorite that was strongly influenced by tufa. These soils are moderately sloping and occur in rolling foothills under a sparse cover of desert shrubs. They have a thin A1 horizon that has an organic-matter content of less than 0.75 percent and a weak Cca horizon.

Representative profile (Unionville very rocky coarse sandy loam, 4 to 8 percent slopes, in an undisturbed area about 615 feet east and 530 feet south of the center of sec. 30, T. 27 N., R. 31 E., Mount Diablo base line and Meridian):

A11—0 to 2 inches, light-gray (10YR 7/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) when moist; weak, thin, platy structure; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; few, very fine roots; many, medium vesicular pores; strongly calcareous; pH at 1 to 5 dilution is 8.6; abrupt, smooth boundary.

A12—2 to 6 inches, light brownish-gray (2.5Y 6/2) sandy loam, dark brownish gray (2.5Y 4/2) when moist; very weak, platy structure; hard when dry, friable when moist, slightly sticky when wet; few, fine roots; many, medium vesicular pores; very strongly calcareous; strongly alkaline; pH at 1 to 5 dilution is 8.6; abrupt, smooth boundary.

C1—6 to 9 inches, light-gray (10YR 7/2) coarse sandy loam that contains slightly more clay than horizon above and is grayish brown (10YR 5/2) when moist; weak, medium and fine, subangular blocky structure; hard when dry, friable when moist, slightly sticky when wet; very few, fine roots; common, fine tubular pores; very strongly calcareous; few, coarse, faint lime mottles and, on a few pebbles, lime coatings of light yellowish brown (10YR 6/4); pH at 1 to 5 dilution is 9.0; clear, smooth boundary.

C2—9 to 16 inches, light-gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few, very fine roots; many, very fine pores; very strongly calcareous; pH at 1 to 5 dilution is 9.0; clear, smooth boundary.

C3—16 to 20 inches, light brownish-gray (10YR 6/2) very coarse sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful, very fine roots; many, very fine pores; slightly calcareous; pH at 1 to 5 dilution is 9.0; clear, smooth boundary.

C4ca—20 to 22 niches, light brownish-gray (2.5Y 6/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful, very fine roots; many, very fine pores; very strongly calcareous; many, fine, faint veins and seams of light yellowish-brown lime; pH at dilution of 1 to 5 is 8.8; clear, wavy boundary.

C5—22 to 27 inches, light brownish-gray (2.5Y 6/2) loamy very coarse sand, dark grayish brown (2.5Y 4/2) when moist; massive; soft when dry, very friable when moist, nonsticky when wet; plentiful, very fine roots; many, very fine pores; moderately calcareous; pH at 1 to 5 dilution is 9.0; clear, wavy boundary.

R—27 inches +, decomposing granodiorite bedrock; noncalcareous; pH at 1 to 5 dilution is 8.4.

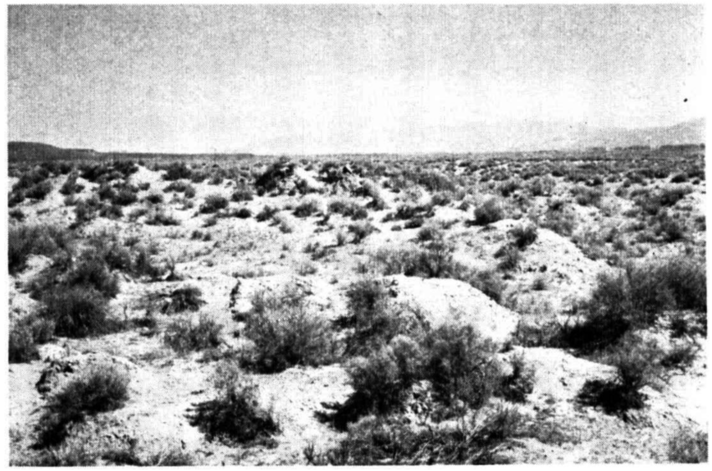

Figure 14.—**Quincy fine sand, 0 to 15 percent slopes. Sand dunes are partly stabilized by greasewood and dahlia.**

Quincy series: The Quincy series consists of excessively drained, coarse-textured soils that developed in sandy eolian deposits derived from acidic and basic igneous rocks and from sedimentary rocks. These soils occur in areas of sand dunes that are nearly level to strongly sloping. The dunes are high and broad or low and hummocky, and they are partly stabilized by a sparse cover of shrubs (fig. 14).

Representative profile (Quincy fine sand, 0 to 15 percent slopes, in an undisturbed area about 350 feet west and 220 feet south of the northeast corner of sec. 25, T. 27 N., R. 31 E., Mount Diablo base line and meridian):

C1—0 to 6 inches, dominantly light brownish-gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) when moist; consists of fine and very fine grains of dark-gray (10YR 4/1) magnetite, a light grayish-brown (2.5Y 5/2), unidentified mineral material, colorless quartz, mica flakes, and few, white fragments of the shells from mollusks; single grained; loose when dry or moist, nonsticky and nonplastic when wet; plentiful, very fine and few, fine roots; many, very fine pores; noncalcareous; pH at 1 to 5 dilution is 8.0; diffuse, smooth boundary.

C2—6 to 60 inches +, similar to the surface horizon, except that the content of roots decreases with depth, and the soil is slightly calcareous in spots.

Intrazonal soils

Intrazonal soils have more or less well-developed soil characteristics that reflect the dominant influence of some local factor of relief or parent material over the normal effects of climate and vegetation. The intrazonal soils in the Lovelock Area are in the Humic Gley and Solonetz great soil groups.

HUMIC GLEY SOILS

Humic Gley soils are poorly drained or very poorly drained hydromorphic soils that have moderately thick, dark-colored, organic-mineral horizons over mineral horizons that are gleyed (*9*). In the Lovelock Area these soils are on the smooth, nearly level deltaic flood plain. They

have some characteristics of Alluvial soils but have a dark-colored A1 horizon high in organic-matter content and a gleyed subsoil or substratum. The soils in this group have formed where drainage was poor or very poor and iron compounds were reduced to soluble forms. Dense growths of grasses and aquatic plants produced a large amount of organic matter, which darkened the A1 horizon.

In this Area the Humic Gley soils are in the Humboldt, Lovelock, and Ryepatch series. Originally these soils were more poorly drained than they are today. Drainage has been improved by diverting irrigation water, constructing Rye Patch Reservoir, and installing deep drains.

Humboldt series: The Humboldt series consists of very deep, somewhat stratified, moderately fine textured and fine textured soils that are imperfectly drained. These soils developed on nearly level flood plains and deltas under a luxuriant growth of grasses and sedges. The parent material came from limestone, basalt, tuff and other rocks, and from reworked lacustrine deposits. In undisturbed areas the soils are strongly saline-alkali. The A1 horizon has an organic-matter content of more than 3.5 percent.

Representative profile (Humboldt silty clay in a cultivated area about 300 feet east and 180 feet south of the apparent northwest corner of sec. 35, T. 27 N., R. 31 E., Mount Diablo base line and meridian):

Ap—0 to 8 inches, gray (10YR 5/1) silty clay, black (10YR 2/1) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; abundant, very fine, fine, and medium roots; few, very fine tubular pores; numerous worm casts; slightly calcareous; pH 7.8 (saturated paste); clear, smooth boundary.

A1—8 to 14 inches, similar to horizon above except that worm casts are few to common, and boundary is gradual and irregular.

C1—14 to 18 inches, light-gray (2.5Y 7/2) silty clay loam, very dark grayish brown (2.5Y 3/2) when moist, with dark-brown (10YR 3/3) organic stains on some ped surfaces; strong, coarse, medium and fine, angular and subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; plentiful, very fine and fine roots; common, very fine tubular pores; few, fine, firm lime nodules and few, faint, pale-brown (10YR 6/3) lime seams on some ped faces; slightly calcareous; pH 7.6 (saturated paste); clear, irregular boundary.

C2—18 to 24 inches, gray (10YR 6/1) silty clay, very dark gray (10YR 3/1) when moist; strong, fine, angular and subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; plentiful, very fine and fine roots; many, very fine and few, fine tubular pores; few, extremely fine, firm lime nodules; very slightly calcareous; pH 7.4 (saturated paste); clear, smooth boundary.

IIC3g—24 to 33 inches, light greenish-gray (5GY 6/1) clay, dark greenish gray (5GY 4/1) when moist, with common, very fine, faint iron mottles of dark brown (10YR 3/3); weak, medium and coarse, subangular blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; plentiful, very fine and fine roots; few, fine tubular pores; slightly calcareous; pH 7.5 (saturated paste); clear, smooth boundary.

IIIC4—33 to 38 inches, light-gray (10YR 7/2) silty clay, grayish brown (10YR 5/2) when moist, with few, fine, faint iron mottles of very dark grayish brown (10YR 3/2); weak, medium and coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful, very fine and fine roots; common, very fine and fine tubular pores; slightly calcareous; pH 7.6 (saturated paste); clear, smooth boundary.

IVC5—38 to 46 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist, with a few, coarse, distinct organic streaks of very dark gray (10YR 3/1); weak, medium and coarse, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful, very fine and few, fine roots; common, very fine and fine tubular pores; slightly calcareous; pH 7.7 (saturated paste); clear, smooth boundary.

IVC6—46 to 51 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; massive; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful, very fine roots; common, very fine and fine tubular pores; very slightly calcareous; pH 7.7 (saturated paste); clear, smooth boundary.

IVC7—51 to 56 inches +, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful, very fine roots; many, very fine and fine tubular pores; moderately calcareous; pH 7.7 (saturated paste).

Lovelock series: In the Lovelock series are very deep, stratified, medium-textured to fine-textured soils that are poorly drained or imperfectly drained. These soils developed in alluvium deposited at the mouth of streams where deltas merge with lakebeds. The parent material was derived from limestone, basalt, tuff, and other rocks and from reworked lacustrine sediments. The soils occur in slightly concave, nearly level areas near the edge of Humboldt Lake. They have a high content of diatomaceous earth, volcanic glass, and organic matter, and their bulk density is less than 1.0 in most strata.

Mechanical analyses indicate that Lovelock soils are clay or silty clay, but because these soils contain a large amount of diatomaceous earth and volcanic glass, they are managed more like silt loam than clay. The A1 horizon is generally more than 15 inches thick and has an organic-matter content of 5 to 15 percent. The carbon-nitrogen ratio varies widely; it depends on how long the soil has been cultivated. It ranges from about 20 in uncultivated areas to 12 in areas that have been cultivated for more than 20 years. The content of calcium carbonate, or its equivalent, also varies widely, depending on the amount of mollusk shells and shell fragments in each horizon.

Representative profile (Lovelock silt loam, slightly saline, in a cultivated area 100 feet west and 50 feet south of the northeast corner of sec. 19, T. 25 N., R. 31 E., Mount Diablo base line and meridian):

Ap—0 to 12 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; moderate, fine, granular structure; hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful, very fine and fine fibrous roots; many, very fine and fine pores; strongly calcareous; pH at 1 to 10 dilution is 8.6; abrupt, smooth boundary.

IIA1—12 to 18 inches, gray (N 5/0) silty clay, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure; slightly hard to very hard when dry, friable when moist, sticky and plastic when wet; plentiful, very fine and few, fine roots; common, very fine and few, fine tubular pores; strongly calcareous with few, fine, white shells and shell fragments from fresh water mollusks; pH at 1 to 10 dilution is 8.5; abrupt, smooth boundary.

IIIC1g—18 to 23 inches, light-gray (10YR 7/2), stratified clay loam and clay, grayish brown (10YR 5/2) when moist; few, fine, distinct iron mottles of light brown (7.5YR 6/4); few, coarse, distinct stains of very dark gray (10YR 3/1) from organic matter in the horizon above; weak, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet;

plentiful, very fine roots; common, fine tubular pores; strongly calcareous; few, fine, white fragments of shells from fresh water mollusks; pH at 1 to 10 dilution is 8.6; abrupt, smooth boundary.

IVC2—23 to 29 inches, light-gray (5Y 6/1) silt loam, gray (5Y 5/1) when moist; weak, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful, very fine roots; many, very fine tubular pores; strongly calcareous with few, fine, white shell fragments from fresh water mollusks; pH at 1 to 10 dilution is 8.6; abrupt, smooth boundary.

VC3—29 to 40 inches, gray, stratified clay and silty clay, very dark gray when moist; many, fine and medium, prominent flecks of white lime and splotches of lime; weak, medium, subangular blocky structure; hard when dry, friable or firm when moist, sticky and plastic when wet; few, very fine roots; few, very fine tubular pores; strongly calcareous; many, fine, white shells and shell fragments from mollusks; pH at 1 to 10 dilution is 8.5; clear, smooth boundary.

VC4g—40 to 60 inches, stratified layers similar to those between 18 and 29 inches; many, coarse, faint organic stains of black (10YR 2/1) on ped faces; many, medium and coarse, white shells and shell fragments from mollusks; pH at 1 to 10 dilution is 8.3 to 8.6.

Ryepatch series: In the Ryepatch series are very deep, imperfectly drained, fine-textured soils that developed on smooth, nearly level, deltaic flood plains under a relatively dense cover of salt- and alkali-tolerant shrubs and grasses. The parent material came from mixed rocks, dominantly limestone, basalt, and tuff, and from reworked lacustrine sediments. In undisturbed areas the soils are strongly saline-alkali. The organic-matter content in the A1 horizon is greater than 5 percent. The soils are more than 55 percent clay and have weak or moderate structure.

Representative profile (Ryepatch silty clay, about 530 feet south and 250 feet east of the NW. corner of NE¼ of sec. 3, T. 25 N., R. 31 E., Mount Diablo base line and meridian):

A1p—0 to 10 inches, silty clay, black (10YR 2/1) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; many, fine roots and common, medium fibrous roots; few, fine root channels; slightly calcareous; pH 7.6; abrupt boundary.

A12—10 to 21 inches, clay, black (10YR 2/1) when moist; moderate, medium, subangular blocky structure breaking to moderate, fine, subangular blocky and blocky structure; hard when dry, firm when moist, very sticky and plastic when wet; many, fine roots and few, medium and coarse fibrous roots; few, dark-brown mottles inside peds; very slightly calcareous; pH 7.5; abrupt, smooth boundary.

C1—21 to 25 inches, clay, very dark grayish brown to dark olive gray (2.5Y 3/2 to 5Y 3/2) when moist; few, thin, black streaks; weak, prismatic structure breaking to moderate, fine and medium, angular and subangular blocky structure; hard when dry, firm when moist; very sticky and plastic when wet; many, fine roots and common, medium fibrous roots; few, fine and medium pores; very slightly calcareous; pH 7.5; abrupt, smooth boundary.

C2g—25 to 39 inches, clay, black (10YR 2/1) when moist; fine, faint, olive-brown (2.5Y 4/4) mottles are common inside peds; moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky structure; hard when dry, firm when moist, very sticky and plastic when wet; many, fine roots and few, medium fibrous roots; very slightly calcareous; pH 7.4; abrupt, smooth boundary.

IIC3—39 to 49 inches, stratified silty clay and silt loam, light olive brown (2.5Y 5/4) to very dark brown (10YR 2/2) when moist; massive to weak, medium, prismatic structure; hard to slightly hard when dry, friable when moist, slightly sticky to very sticky and slightly plastic to very plastic when wet; many to common, fine and few, medium fibrous roots; many to common, fine and common, medium pores; very slightly calcareous; pH 7.8; abrupt, smooth boundary.

IIIC4—49 to 54 inches, clay, black (5Y 2/1) when moist; numerous, fine, faint, dark-brown (7.5YR 4/4) mottles; moderate, medium, subangular blocky structure; hard when dry, firm when moist; very sticky and very plastic when wet; thick, continuous clay films on ped faces; common, fine and few, medium pores; very slightly calcareous; pH 7.1; abrupt, irregular boundary.

IVC5—54 to 65 inches, stratified clay and silt loam, ranging from dark yellowish brown (10YR 3/4) and dark olive (5Y 4/2) in upper part to dark olive gray (5Y 3/2) when moist; weak, medium, subangular blocky structure breaking to weak to moderate, fine, subangular to angular blocky structure; soft to hard when dry, friable to firm when moist, slightly sticky to very sticky and nonplastic to very plastic when wet; thick, continuous clay films; many, very fine and medium fibrous roots; very slightly calcareous; pH 7.1.

SOLONETZ SOILS

Solonetz soils have a friable A horizon that varies in thickness and is underlain by a dark-colored, hard horizon that ordinarily has columnar structure and generally is strongly alkaline. These soils developed under shrubs or grasses, mostly in a subhumid or a semiarid climate (*2*).

In the Lovelock Area, the only soils in this group are the Toy soils. These soils are on nearly level slopes. In some respects they are similar to Humic Gley soils, but they have prismatic structure and have a high content of salts and exchangeable sodium in the subsoil. These soils were poorly drained while they were forming, but now they are imperfectly drained. They have a well-developed, dark-colored A1 horizon that contains a large amount of organic matter because the plant cover was dense when the soils were poorly drained.

Toy series: The Toy series consists of very deep, imperfectly drained, fine-textured soils that occur on nearly level deltaic flood plains. The vegetation is a sparse stand of salt- and alkali-tolerant shrubs and grasses. These soils developed in alluvium derived from andesite, basalt, tuff, limestone, and other rocks and from reworked lacustrine sediments. The A1 horizon has an organic-matter content of more than 3 percent. Excessive sodium has resulted in prismatic structure in the B2 horizon and has aided in the transfer of clay from the A1 horizon to the B2 horizon. The percentage of exchangeable sodium and the content of salt are high in the B2 and the C horizons.

Representative profile (Toy silty clay loam, strongly saline-alkali, about 780 feet east and 370 feet north of the south quarter corner of sec. 2, T. 26 N., R. 31 E., Mount Diablo base line and meridian):

Ap—0 to 9 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) when moist; strong, coarse, subangular blocky structure in the topmost 2 or 3 inches and, below this, moderate or strong, medium and fine, subangular blocky structure; very hard when dry, firm when moist, very sticky and plastic when wet; abundant, very fine and fine roots; few, fine tubular pores; very strongly calcareous; pH 8.5 (saturated paste); abrupt, smooth boundary.

B2t—9 to 32 inches, dark-gray (N 4/0) clay, black (10YR 2/1) when moist; moderate, medium, prismatic structure that breaks to strong, fine, subangular and angular structure; very hard when dry, firm when moist, very sticky and very plastic when wet; abundant, very

fine roots; few, fine tubular pores; thin, continuous clay films in pores, and few, thin, patchy clay films on ped faces; strongly calcareous; pH 8.4 (saturated paste); clear, smooth boundary.

C1—32 to 54 inches, gray (10YR 6/1) silty clay, dark gray (10YR 4/1) when moist; moderate, coarse, subangular or angular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; plentiful, very fine roots; few, very fine tubular pores; moderately calcareous; disseminated lime; pH 8.2 (saturated paste); clear, smooth boundary.

C2—54 to 67 inches +, gray (N 5/0) clay, very dark gray (10YR 3/1) when moist; weak, medium to fine, subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; few, very fine roots; few, very fine tubular pores; slightly calcareous; pH 8.0 (saturated paste).

Zonal soils

Zonal soils are well developed and reflect in their formation the dominant influence of climate and living organisms, chiefly vegetation (*2*). In the Lovelock Area the zonal soils are in only one great soil group, Desert soils.

DESERT SOILS

Desert soils formed under a sparse stand of shrubs in an arid, cool-temperate climate. Because precipitation is low, these soils are normally shallow, are low in content of organic matter, and are only slightly weathered and leached of bases.

The soil surface is normally covered by an erosion pavement of pebbles and cobblestones, some of which have a desert varnish on the upper side. A thin, strongly vesicular A1 horizon occurs except where it has been removed by erosion. This horizon has changed little in color because only a small amount of organic matter has accumulated in it. It contains less than 0.75 percent organic matter.

Underlying the A1 horizon is a thin B2 horizon that differs from the A1 horizon in either texture or color. The B2 horizon has an accumulation of clay or iron, or has blocky or prismatic structure, or has both. The added clay is from the A1 horizon or from mica, feldspar, and similar minerals that weathered to clay. The oxidation of iron or of iron-bearing minerals forms the color B horizon, which has a brighter color than other horizons of the soil.

In some places lime has accumulated in and has mottled or splotched the lower B or the upper C horizon or has crusted the under side of pebbles. The lime is carried in solution from the A1 and upper B horizons and is precipitated as the water evaporates or is used by plants. A substantial amount of lime added to the soil as dust keeps the lime content high.

The relative age of Desert soils is generally indicated by the strength or development of the B2 horizon. It is reflected by the thickness of the B2 horizon or by the amount of clay in the B2 horizon relative to that in the A. A soil of minimal development is the youngest and has the weakest profile, whereas a soil of maximal development is the oldest and has the strongest profile. Medial soils are intermediate in age and in degree of development.

The Desert soils in the Lovelock Area are in the Toulon and Woolsey series.

***Figure 15.*—Profile of Toulon very gravelly loam, 0 to 4 percent slopes. The surface layer is about 9 inches thick. The subsoil is 9 inches thick and shows oxidation of iron minerals. Sand, gravel, and cobblestones make up the substratum.**

Toulon series: In the Toulon series are excessively drained, very gravelly Desert soils that have weak, or minimal, profile development (fig. 15). Their B2 horizon differs from the A1 horizon in color but not in texture. These soils are mainly on the level tops and partly on the sides of offshore bars that formed in prehistoric Lake Lahontan. The parent material consists of waterworn gravel and sand, as well as a small amount of silt that came from quartzite, granodiorite, slate, and tufa and from unidentified rocks. These soils developed in almost barren areas.

Representative profile (Toulon very gravelly loam, 0 to 4 percent slopes, in an undisturbed area about 970 feet west and 1,500 feet south of the northeast corner of sec. 18, T. 26 N., R. 31 E., Mount Diablo base line and meridian):

A11—0 to 3 inches, white (2.5Y 8/2) gravelly silt loam, grayish brown (2.5Y 5/2) when moist; moderate, very thick, platy structure; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; devoid of plant roots; many, medium and coarse vesicular pores; strongly calcareous; pH at 1 to 5 dilution is 9.2; abrupt, smooth boundary.

A12—3 to 10 inches, grayish-brown (2.5Y 5/2) very gravelly sandy loam, dark grayish brown (2.5Y 4/2) when moist; massive; soft when dry, very friable when

moist, slightly sticky and nonplastic when wet; no roots observed; many, fine pores; strongly calcareous; thin coating of lime and some gypsum on the lower side of pebbles; few, small fragments of decomposing tufa; pH at 1 to 5 dilution is 8.6; clear, wavy boundary.

B2—10 to 13 inches, pale-yellow (2.5Y 7/4) very gravelly coarse sandy loam, light olive brown (2.5Y 5/4) when moist; many, fine and medium, prominent stains of strong-brown (7.5YR 5/6) iron oxide on the outside and in fractures of pebbles; thin, pinkish-white (7.5YR 8/2) crusts of lime on the lower side of pebbles; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; no roots observed; many, fine pores; very strongly calcareous; pH at 1 to 5 dilution is 8.4; clear, wavy boundary.

B2—13 to 20 inches, similar to the horizon above, except that it is single grain and is loose when dry or moist; clear, smooth lower boundary.

C—20 to 60 inches +, gray (N 5/0) and pinkish-white (7.5YR 8/2) very gravelly and cobbly very coarse sand, very dark gray (N 3/0) and pinkish white (7.5YR 8/2) when moist; contains clear quartz and other grains of very pale brown (10YR 7/3) sand and fine gravel; single grained; loose when dry or moist, nonsticky and nonplastic when wet; no roots observed; many, fine pores; slightly calcareous in most places but strongly calcareous where a film of lime has accumulated on the lower side of some pebbles; pH at 1 to 5 dilution is 8.4.

Woolsey series: The Woolsey series consists of minimal Desert soils that are deep, somewhat gravelly, moderately coarse textured, and somewhat excessively drained. These soils are on smooth, gently sloping alluvial fans under a sparse stand of desert shrubs. About 50 percent of the surface is covered by an erosion pavement of gravel. The parent materials were derived from many kinds of igneous and sedimentary rocks and from reworked lacustrine sediments. The soils have a light-gray to light brownish-gray A1 horizon that contains a small amount of organic matter and a minimal textural B2 horizon. They are strongly calcareous throughout.

Representative profile (Woolsey gravelly fine sandy loam, 2 to 8 percent slopes, in an undisturbed area about 900 feet west and 100 feet north of the apparent center of sec. 22, T. 25 N., R. 31 E., Mount Diablo base line and meridian):

A11—0 to 2 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; no roots; many, fine pores; strongly calcareous; pH at 1 to 5 dilution is 8.6; abrupt, smooth boundary.

A12—2 to 5 inches, light-gray (10YR 7/2) fine sandy loam that is approximately 10 percent gravel, grayish brown (10YR 5/2) when moist; very weak, thick, platy structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few, very fine and fine roots; many, very fine tubular pores; strongly calcareous; pH at 1 to 5 dilution is 8.6; clear, smooth boundary.

B2t—5 to 9 inches, grayish-brown (10YR 5/2) gravelly heavy sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; few, very fine and fine roots; common, very fine tubular pores; common, thin clay films in pores and common, thin clay bridges between sand grains; moderately calcareous; few, medium or large, white lime coatings on pebbles; pH at 1 to 5 dilution is 8.6; clear, smooth boundary.

B3—9 to 21 inches, grayish-brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few, very fine roots; many, very fine pores; few, thin clay bridges between sand grains; moderately calcareous; few, fine or medium, prominent coatings of white lime on lower side of pebbles; pH at 1 to 5 dilution is 8.6; clear, wavy boundary.

C—21 to 44 inches +, grayish-brown (10YR 5/2), stratified sandy loam and gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular block structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; very few, very fine roots; common, very fine and few, fine tubular pores; moderate or strongly calcareous; disseminated lime and few, fine or medium lime mottles; pH at 1 to 5 dilution is 8.8.

Laboratory Data

Table 11 shows the results of mechanical and chemical analyses of five soils mapped in the Lovelock Area.

Standard methods were used to obtain the data in table 12. Determinations of particle size distribution were made by the pipette method. The reaction was measured with a Beckman glass electrode. Determinations of electrical conductivity, soluble cations and anions, cation-exchange capacity, and moisture retention were made by methods described in USDA Handbook No. 60 (*10*). Organic carbon was determined by heat of dilution as described in USDA Circular 757 (*7*). Total nitrogen was determined by the AOAC (Association of Official Agricultural Chemists) Kjeldahl method. Extractable cations were determined by methods described in USDA Circular 757. Sodium and potassium in the saturation extract were analyzed through the use of a Beckman flame spectrophotometer. Calcium and magnesium were determined by methods described in USDA Handbook No. 60. The $CaCO_3$ equivalent was determined by adoption of a modified Parsons method.

Additional Facts About the Area

This section is primarily for those who are not familiar with the Lovelock Area. It discusses early settlement and development, community facilities, climate, and other subjects of general interest.

Settlement and Development

Before the first white men came, the Paiute and possibly the Washoe Indians camped in Lovelock Valley when hunting waterfowl. Relics and other evidence of camping and hunting are abundant near Humboldt Lake.

The first white settlers arrived during the gold rush of 1849. At that time the Humboldt River ended about 2 miles below the present town of Lovelock, but from its end water spread out over a moderately large area of natural meadow and tule swamps that were drained by sloughs emptying into Humboldt Lake. Early immigrants, traveling westward in wagon trains, used the valley to rest and recuperate. They called the valley Big Meadows because of its lush growth of native plants (*4*).

The development of irrigation began in 1862 when water was first diverted from the Humboldt River. After the Central Pacific Railroad reached the valley in 1867 and additional acres were irrigated, the settlers began feeding large numbers of livestock. Irrigation was expanded rapidly, and by 1890 a large part of the Lovelock Valley was irrigated. As many as 24,000 acres were irrigated in years when the flow of the Humboldt River was heavy, but even in those years the supply of water was insufficient late in the season. In 1913 the Pitt-Taylor Reservoirs were formed when a group of landowners built two small storage dams to stabilize the supply of irrigation water for their lands.

The development of irrigation was haphazard and unregulated until comparatively recent times. As a consequence, more soil was put under cultivation than could be

TABLE 11.—*Laboratory analyses*

[Analyses made at Soil Survey Laboratory, Soil Conservation Service,

Soil	Depth	Particle size distribution									Moisture held at 15 atmospheres	Reaction	
		Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand 0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)	Fine sand (0.2 to 0.02 mm.)[1]	Silt (0.02 to 0.002 mm.)[1]		Saturated paste	1:10
Humboldt silty clay:	*Inches*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*pH*	*pH*
Location: About 300 feet E. and 180 feet S. of NW. corner, sec. 35, T. 27 N., R. 31 E. (*Survey No.* S56–Nev–14–3–1 to 14–3–8; *Laboratory No.* 56317–56324).	0–8	0. 1	0. 3	0. 3	1. 9	3. 9	50. 2	43. 3	15. 7	39. 8	24. 9	7. 8	8. 4
	8–14	. 0	. 1	. 1	1. 9	3. 7	52. 0	42. 2	14. 3	42. 9	26. 2	7. 8	8. 4
	14–18	. 0	. 0	. 1	. 7	1. 5	59. 2	38. 5	9. 5	51. 8	24. 1	7. 6	8. 4
	18–24	. 0	. 1	. 1	. 6	1. 0	49. 3	48. 9	6. 7	44. 0	26. 1	7. 4	7. 9
	24–33	. 1	. 2	. 1	. 5	. 6	35. 7	62. 8	5. 2	31. 4	29. 5	7. 5	7. 9
	33–38	. 1	. 1	. 2	1. 9	5. 5	49. 8	42. 4	21. 4	35. 5	23. 2	7. 6	8. 3
	38–46	. 0	. 1	. 3	7. 2	22. 0	54. 0	16. 4	57. 9	24. 6	12. 8	7. 7	8. 4
	46–51	. 0	. 1	. 2	3. 5	18. 9	62. 8	14. 5	67. 3	17. 4	12. 2	7. 7	8. 3
Placeritos loam:													
Location: About 30 feet W. and 30 feet N. of SE. corner, sec. 23, T. 27 N., R. 31 E. (*Survey No.* S56–Nev–14–11–1 to 14–11–7; *Laboratory No.* 56378–56384).	0–6	.2	.6	2.1	12.6	19.7	48.3	16.5	57.0	20.1	11.0	8.0	8.7
	6–13	.1	.8	1.9	8.0	15.6	55.9	17.7	50.8	26.1	11.8	8.2	8.9
	13–20	.1	1.1	3.1	11.2	18.9	49.8	15.8	53.9	22.2	10.4	7.9	8.9
	20–26	.0	.1	.2	1.4	3.4	54.6	40.3	9.6	49.4	22.3	7.5	7.9
	26–35	.0	.0	.1	1.6	4.7	55.0	38.6	14.3	46.8	23.1	7.6	8.3
	35–43	.0	.1	.1	1.4	12.7	71.9	13.8	55.8	29.9	11.5	7.9	8.3
	43–60	.0	.1	.1	1.5	7.2	78.3	12.8	49.5	37.3	11.6	7.9	8.7
Ryepatch silty clay:													
Location: About 530 feet S. and 250 feet E. of NW. corner of NE¼ sec. 3, T. 25 N., R. 31 E. (*Survey No.* S56–Nev–14–7–1 to 14–7–9; *Laboratory No.* 56345–56353).	0–10	.5	.9	.9	3.3	4.3	31.4	58.7	13.4	24.3	30.6	7.6	8.3
	10–21	.0	.1	.2	.8	1.3	20.8	76.8	5.3	17.4	37.6	7.5	8.0
	21–25	.0	.0	.0	.2	.5	19.5	79.8	1.0	19.1	36.2	7.5	8.0
	25–39	.0	.1	.1	.9	1.6	21.2	76.1	5.8	17.6	37.3	7.4	7.9
	39–42												
	42–49	.1	.6	1.1	4.1	9.0	45.1	40.0	26.0	31.0	28.9	7.3	7.8
	49–54	. 0	. 1	. 1	. 6	1. 6	16. 4	81. 2	6. 7	11. 7	36. 1	7. 1	7. 5
	54–56												
	56–65+	. 1	. 1	. 2	1. 0	2. 2	23. 3	73. 1	7. 8	18. 4	33. 6	7. 1	7. 4
Sonoma silty clay loam:													
Location: About 535 feet E. and 165 feet S. of NW. corner, sec. 1, T. 26 N., R. 31 E. (*Survey No.* S56–Nev–14–2–1 to 14–2–8; *Laboratory No.* 56309–56316).	[5] 0–8	. 3	. 6	. 3	3. 1	10. 3	54. 2	31. 2	34. 6	32. 3	17. 7	7. 9	8. 4
	8–13	. 0	. 1	. 1	2. 2	11. 5	55. 3	30. 8	37. 3	31. 3	21. 9	8. 0	8. 5
	[5] 13–21	. 1	. 1	. 2	1. 3	5. 6	66. 9	25. 8	39. 2	34. 3	16. 3	8. 0	8. 6
	21–33	. 0	. 0	. 1	3. 0	13. 3	56. 2	27. 4	39. 4	32. 8	16. 4	7. 8	8. 5
	33–46	. 4	. 3	. 1	. 6	2. 1	49. 3	47. 2	11. 8	40. 1	24. 8	7. 7	8. 5
	46–51	. 5	. 2	. 1	. 4	3. 5	69. 1	26. 2	27. 4	45. 5	17. 3	7. 8	8. 6
	51–55	. 3	. 2	. 1	. 4	1. 1	70. 3	27. 6	19. 6	52. 1	19. 2	7. 8	8. 5
	55–65+	. 2	. 2	. 1	. 3	. 4	65. 8	33. 0	9. 9	56. 5	21. 9	7. 8	8. 2
Toy silty clay loam:													
Location: About 780 feet E. and 370 feet N. of SW. corner of SE¼ sec. 26, T. 26 N., R. 31 E. (*Survey No.* S56–Nev–14–5–1 to 14–5–6; *Laboratory No.* 56332–56337).	0–9	. 7	. 9	. 8	3. 3	5. 3	50. 4	38. 6	22. 4	35. 5	24. 0	8. 5	9. 3
	9–22	. 7	1. 3	. 7	1. 7	3. 0	29. 6	63. 0	12. 6	21. 0	34. 3	8. 4	9. 3
	22–32	[6] 3. 4	2. 0	. 8	1. 4	. 9	31. 6	59. 9	4. 5	28. 8	32. 2	8. 3	9. 1
	32–42	[6] 1. 6	. 6	. 2	. 2	. 1	48. 8	48. 5	2. 1	46. 9	32. 6	8. 2	8. 8
	42–54	[6] . 9	. 6	. 1	. 2	. 4	40. 2	57. 6	2. 4	38. 3	35. 5	8. 1	8. 7
	54–62	[6] . 7	. 3	. 1	. 6	1. 7	24. 4	72. 2	7. 6	18. 9	38. 0	8. 0	8. 3

[1] International classification.
[2] Trace.
[3] Calcium and magnesium.

irrigated by the normal flow of the river. In 1921 the State Engineer stopped issuing permits for the use of water directly from the stream.

Late in the twenties and early in the thirties, drought shrank the water supply and forced irrigation to be abandoned on all except about 10,000 acres. In 1935 there were only 9,000 partially irrigated acres. Because a stabilized water supply was needed, the Rye Patch Reservoir was built by the Bureau of Reclamation in 1935 and 1936. Since that time the supply of water has been more dependable, and the area irrigated has increased to approximately 35,000 acres. Lovelock Valley is now a center of agricultural and livestock feeding in the State.

The population of the valley is about 2,000, including about 1,600 in the town of Lovelock. For a living, residents of Lovelock depend on farming and ranching, in the

of five representative soils

Riverside, Calif. Dashes indicate values not determined]

Organic matter			Electrical conductivity (millimos per centimeter at 25° C.)	$CaCO_3$ equivalent	Cation exchange capacity (sodium acetate)	Extractable cations		Percentage of exchangeable sodium	Saturation extract (soluble)				Moisture at saturation
Organic carbon	Nitrogen	Carbon-nitrogen ratio				Sodium	Potassium		Sodium	Potassium	Calcium	Magnesium	
Percent	*Percent*			*Percent*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Percent*	*Meq./l.*	*Meq./l.*	*Meq./l.*	*Meq./l.*	*Percent*
2. 16	0. 199	10. 9	1. 3	2	47. 7	3. 9	4. 8	8. 2	11. 3	1. 0	4. 0	1. 5	69. 9
1. 42	. 137	10. 4	1. 3	1	46. 1	3. 6	4. 2	7. 8	10. 3	. 8	4. 4	5. 2	67. 1
. 84	. 079	10. 6	1. 6	1	41. 5	3. 0	3. 3	7. 2	10. 3	. 7	4. 7	1. 7	64. 9
. 67	. 068	9. 9	2. 4	(2)	43. 6	3. 9	3. 4	8. 9	13. 1	. 8	6. 7	1. 4	71. 1
. 73	. 060	12. 2	3. 9	1	48. 1	5. 7	3. 4	11. 9	21. 0	. 7	9. 9	1. 9	81. 2
. 48	. 050	9. 6	4. 1	1	41. 3	7. 0	2. 5	16. 9	37. 0	. 6	10. 6	4. 6	62. 4
. 29	--------	--------	4. 8	1	25. 9	5. 3	1. 5	20. 5	42. 3	. 6	10. 2	4. 6	46. 4
. 18	--------	--------	3. 1	(2)	25. 4	4. 7	1. 6	18. 5	30. 8	. 6	6. 5	2. 6	45. 5
1.23	.120	10.2	1.8	4	22.2	2.3	3.9	10.4	12.9	2.3	3.9	2.4	43.6
.68	.070	9.7	2.4	6	22.8	3.8	3.0	16.7	20.1	1.2	3.5	.8	39.4
.43	.048	9.0	4.2	4	20.3	3.5	2.0	17.2	33.3	1.1	6.0	3.5	42.9
.91	.086	10.6	8.0	1	41.0	3.6	3.2	8.8	45.5	1.7	27.1	14.0	57.2
.61	.064	9.5	4.1	1	40.4	5.3	3.5	13.1	30.8	1.0	7.2	4.0	63.2
.26	--------	--------	2.8	3	23.7	3.5	2.4	14.8	20.8	.9	3.9	2.4	50.2
.20	--------	--------	2.9	5	23.3	2.9	2.4	12.4	19.5	1.1	5.5	3.0	45.0
3.26	.309	10.6	2.4	1	54.0	8.1	4.9	15.0	15.8	1.2	[3] 8.4	--------	82.9
2.04	.148	13.8	2.2	(2)	51.8	8.0	3.1	15.4	15.8	4.3	[3] 4.3	--------	94.4
1.11	.071	15.6	2.0	(2)	51.3	8.3	2.7	16.2	15.5	.3	1.2	.3	97.5
1.51	.100	15.1	3.7	(2)	49.1	7.7	3.0	11.2	27.5	.6	6.3	2.5	103.4
.94	.118	8.0	6.9	(2)	39.8	5.5	2.5	13.8	45.0	.7	19.6	8.1	98.7
.95	.053	17.9	9.3	(2)	47.2	6.4	2.9	13.6	51.5	1.2	31.1	12.3	107.8
.61	.045	13.6	15.0	(2)	[4] 41.4	4.0	2.8	9.7	110.0	1.9	58.6	23.6	99.6
1.76	.173	10.2	1.7	8	32.1	2.5	3.2	7.8	11.1	.9	4.8	3.0	60.5
1.00	.111	9.0	1.5	8	30 7	2.7	2.9	8.8	10.8	.8	3.5	1.9	53.8
.55	.066	8.3	1.5	7	28.6	2.9	2.5	10.1	14.9	.8	2.4	1.6	51.2
.50	.062	8.1	2.1	7	28.2	3.5	2.3	12.4	19.8	.8	3.2	.8	56.6
.61	.059	10.3	2.2	3	42.0	7.2	4.8	17.1	25.0	1.1	3.7	2.2	65.9
.25	--------	--------	3.6	4	32.3	5.7	3.6	17.6	26.8	1.2	4.0	2.5	54.9
.26	--------	--------	3.2	5	32.7	5.9	3.6	18.0	25.8	1.1	4.4	2.8	60. 2
.28	--------	--------	3.2	4	36.6	6.2	4.1	16.9	24.3	1.1	4.3	2.6	67.8
2.86	.220	13.0	5.7	15	41.6	19.1	7.5	45.9	58.5	2.2	1.9	1.0	66.3
.96	.063	15.2	7.0	8	45.3	27.7	5.0	61.1	72.5	1.0	1.2	.6	125.0
.65	.045	14.8	6.5	8	42.2	26.8	4.4	63.5	60.5	.8	.8	.7	114.6
.42	.044	9.5	7.6	4	41.8	24.2	3.9	57.8	70.5	.8	1.2	1.0	93.1
.44	.044	10.0	7.7	2	42.4	26.9	3.8	63.4	66.0	.6	1.4	1.4	100.5
.76	.056	13.6	7.2	1	47.4	23.4	3.7	49.4	70.0	.6	1.4	1.4	108.0

[4] Contains 2.9 milliequivalents of gypsum per 100 grams of soil.

[5] Bulk density (grams per cubic centimeter): 1.22 at depth of 0 to 8 inches; 1.15 at depth of 13 to 21 inches.

[6] Includes the following percentages of particles larger than 2 millimeters: 3 percent at depth of 22 to 32 inches, 4 percent at depth of 32 to 42 inches, 3 percent at depth of 42 to 54 inches, and 2 percent at depth of 54 to 62 inches.

TABLE 12.—*Temperature, precipitation, and evaporation*

[All data, except those on evaporation, are from the Lovelock Station; evaporation data are from the station at Rye Patch Reservoir]

Month	Temperature [1]			Average monthly precipitation [2]	Average monthly evaporation [3]
	Average daily maximum	Average daily minimum	Average monthly		
	° F.	° F.	° F.	Inches	Inches
January	41.8	16.6	29.2	0.82	(4)
February	48.2	22.3	35.2	.71	(4)
March	57.5	27.6	42.5	.54	(4)
April	67.3	34.7	51.0	.53	(4)
May	75.5	42.6	59.1	.46	[5] 8.97
June	83.2	48.8	66.0	.62	10.69
July	94.7	55.0	74.9	.13	13.71
August	92.9	52.2	72.5	.14	11.86
September	84.2	44.5	64.4	.20	[5] 8.74
October	70.9	34.9	52.9	.54	[6] 4.73
November	55.4	24.4	39.9	.42	(4)
December	45.8	20.5	33.1	.65	(4)
Year	68.1	35.3	51.7	5.76	[7] 72.0

[1] Average temperature based on a 22-year record, through 1952.
[2] Average precipitation based on a 25-year record, through 1955.
[3] Average evaporation based on a 20-year record, through 1960.
[4] Amount is included in yearly average but is not significant for the month.
[5] One year missing.
[6] Six years missing.
[7] Average annual evaporation based on a 20-year record, through 1955. Source of data was "Evaporation Maps for the United States," U.S. Weather Bureau Tech. Paper No. 37.

valley and in outlying areas, and on local businesses, the railroad, tourist trade, and mining.

Most of the land in Lovelock Valley is privately owned, but some nonirrigated land is federally owned and is administered by the Bureau of Land Management. The Lovelock Valley is divided generally by the town of Lovelock into Upper Valley to the north and Lower Valley to the south. Of the total area and number of landowners in Lovelock Valley, only one-third of the acreage but two-thirds of the landowners are in Upper Valley. The remaining acreage and landowners are in Lower Valley.

Community Facilities

A main line of the Southern Pacific Railroad that runs between Ogden and San Francisco crosses the Lovelock Area from northeast to southwest and serves the town of Lovelock. U.S. Interstate Highway 80 (U.S. Highway 40), which roughly parallels the railroad, provides a route to markets and to population centers elsewhere in northern Nevada and in adjoining States. The Area is served by bus and truck lines but not by an airline, though scheduled air transportation is available at Reno. If arrangements are made at Reno, chartered air service is available at Lovelock.

Many farm roads are paved. Outside the farming area, gravel or other kinds of roads are maintained. Uninhabited parts of the survey area are accessible only by ungraded roads or trails.

Public schools, operated by the Pershing County School District, serve the Area at Lovelock. From the farms and outlying communities, students are transported to and from school in buses. Each school has a library for students and teachers, and a county library is at Lovelock. Also at Lovelock are physicians and dentists, a hospital maintained by the county, churches and chapels of many denominations, lodges, veterans' organizations, and social and service groups.

Electricity and telephones are available at Lovelock and at many of the farms and ranches. A pipeline from wells several miles to the northeast supplies domestic water to Lovelock. The pipeline has been recently extended to provide water for homes and livestock in the farming and ranching communities. The Area is served by a television station at Reno, by radio stations at Reno, Fallon, and Winnemucca, and by a local weekly newspaper and two daily newspapers printed at Reno.

Pershing County and the town of Lovelock provide a swimming pool, a playground, and a baseball field. Baseball leagues, primarily for school-aged children, are sponsored by local merchants. Throughout the farming area, there are excellent facilities for hunting upland and migratory birds. Fishing, boating, and other water activities are provided at Rye Patch Reservoir. A movie theater is located in Lovelock.

Climate [3]

The Lovelock Area has an arid, continental climate. Sunshine is abundant, precipitation is low, the rate of evaporation is high, and the air is dry. In summer the days are warm but the nights are cool. Winters are cold. Table 12 gives temperature, precipitation, and evaporation data compiled from records of the United States Weather Bureau.

In this Area, as in much of the Great Basin, climate is influenced greatly by the Sierra Nevada, a massive range of mountains that lies along the western edge of Nevada. This is especially true of precipitation.

Most of the moisture that falls in the Area comes from the Pacific Ocean. During the period from fall through spring, storms bring moisture inland from the ocean. The moist marine air approaches the western slopes of the Sierra Nevada, and as the air is lifted, it cools by expansion and releases rain or snow. On the leeward side of the mountains, descending air is warmed by compression and the precipitation lessens. Consequently, the prevailing air currents that reach the Lovelock Area are dry, and precipitation is light. The dry area on the leeward side of the mountains is said to be in a rain shadow.

In addition, precipitation is low in the Lovelock Area for other reasons. The Area is far from a large body of water, and it lies in the rain shadow of the Trinity Mountains, which are a few miles west of the Area and rise to an elevation of more than 7,000 feet.

After the westerly winds pass over Lovelock Valley, they approach the Humboldt Range to the east, where the highest point is more than 9,000 feet in elevation. Because moisture is released when the winds rise, precipitation along the western slope of these mountains is heavier than it is in the valley.

[3] E. ARLO RICHARDSON, State climatologist, U.S. Weather Bureau, helped to prepare this subsection.

TABLE 13.—*Probabilities of last low temperatures in spring and first in fall*

[Estimates are for Lovelock Valley; elevation, 3,900 to 4,000 feet]

Probability	Dates for given probability of temperature				
	16° F. or less	20° F. or less	24° F. or less	28° F. or less	32° F. or less
Spring:					
1 year in 10 later than	April 7	April 26	May 11	May 26	June 7.
25 years in 100 later than	March 26	April 15	April 29	May 13	May 26.
5 years in 10 later than	March 13	April 1	April 16	April 30	May 13.
Fall:					
1 year in 10 earlier than	October 23	October 14	October 2	September 20	September 6.
25 years in 100 earlier than	November 1	October 23	October 10	September 29	September 15.
5 years in 10 earlier than	November 11	November 2	October 21	October 9	September 25.

The average annual precipitation in the Area is about 5 or 6 inches. Of this, about 40 percent comes in December, January, and February. During the growing season, rainfall normally amounts to only 1 to 1½ inches and is not enough for crops that are not irrigated. Long dry spells are fairly common late in summer and early in fall. The average precipitation from July through September totals only about one-half inch.

Snowfall is normally light, about 10 to 12 inches annually. Its yearly total is rarely more than 2 feet.

Thunderstorms occur on an average of 10 to 12 days in a year. Although heavy, dashing rains are rare, at times more than 1 inch of rain falls in a few hours. The occasional hailstorms do little damage because the hailstones are generally small.

Because the Area is at fairly high elevations, and because the sky is dominantly clear and the air is dry, the daily range in temperature is great. It averages 25° F. in winter and 38° in summer. In summer the temperature is often between 95° and 100° and is occasionally above 100°. The humidity is low, however, and the heat of summer days is not oppressive. Summer nights are generally cool.

In winter the nights are cold because air drains into the valley from the surrounding mountain slopes. The temperature occasionally falls below zero, but long periods of very low temperatures are rare because cold Arctic air is blocked by the Rocky Mountains to the east and northeast.

Winter days are seldom uncomfortably cold. On most days in winter, the temperature rises into the 40's.

Winds are mostly light to moderate, generally less than 20 miles per hour. Occasionally strong, gusty winds accompany the local thundershowers in the warmer months of the year and accompany the storm fronts that cross the Area in fall, winter, and spring. In spring for several days at a time, warm, southerly winds of moderate to strong velocity may blow and reduce the effectiveness of precipitation.

Principally because of the dry air and the hot summer days, the evaporation rate is high. Evaporation from a free water surface averages 75 inches annually. Of this total, 75 to 80 percent occurs from May through September. The average rate of evaporation during each of these months, as recorded at Rye Patch Reservoir, is shown in table 12.

Tornadoes are virtually unknown in the Area, and they are extremely rare in Nevada. From 1916 to 1959, the only tornado reported occurred elsewhere in the State.

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The average frost-free period, or growing season, extends from the middle of May to the latter part of September, a period of about 4½ months. Table 13 gives data on the probability of low temperatures in spring and in fall.

Water

A large part of Lovelock Valley is in the Humboldt Irrigation Project. This project is located in Lahontan Basin on the nearly level, lower flood plain of the Humboldt River. Precipitation in the valley is normally low, and irrigation is required to produce crops economically. All water for irrigation is obtained from the Humboldt River—the stream most important to agriculture in Nevada, and the only major stream flowing entirely within the State. The river and its tributaries furnish irrigation water for more than 300,000 acres of cropland and pasture in Nevada (*6*).

The Humboldt River drains a watershed of about 13,700 square miles in northern Nevada. It rises in the mountains of Elko County, where precipitation is moderately high, and flows nearly 300 miles westward to Humboldt Lake, where much of the water evaporates. The river cuts through several mountain ranges, though most streams in Nevada follow structural troughs. It meanders extensively and has an estimated length of 750 miles. In one of its valleys, 130 miles long, the river meanders for 380 miles. Below Palisade, about 150 miles east of Lovelock, it receives little water from tributaries.

Many diversion dams have been built on the river above Rye Patch Reservoir, but most of them cannot regulate the amount of water diverted; consequently, proper distribution is difficult. The State Engineer is responsible for distributing the rights to water for irrigation. Since early in the 1930's, a concerted effort has been made to deliver the amount of water allotted to farms and ranches under water rights. The water comes from direct flow in the river, from Rye Patch and the Pitt-Taylor Reservoirs, and, through a transfer of water rights, from the Battle Mountain area. The supply can be increased if more water is transferred from Battle Mountain and if the control of water at the diversion dams is improved

Rye Patch Dam was constructed by the Bureau of Reclamation on the Humboldt River, 24 miles northeast of Lovelock, in 1935 and 1936. The dam was built to hold 179,000 acre-feet of water, but the capacity was later in-

creased to 190,000 acre-feet. The reservoir provides most of the water used for irrigation in the Area, and in most years, stores enough to meet requirements for the next year. Water stored in Rye Patch Reservoir was first made available for irrigation in 1936.

The Pitt-Taylor Reservoirs are shallow, offstream reservoirs that were developed by public and private interests in 1913. These reservoirs are near the upper end of Rye Patch Reservoir and are used for storing water. They were originally designed to hold about 45,000 acre-feet of water, but because the dams and their embankments have deteriorated, the present capacity is no more than 18,000 acre-feet. They are now used only in years when excess water in Rye Patch Reservoir overflows the spillway. If water is stored in upper Pitt-Taylor Reservoir, it is released as space in Rye Patch Reservoir is made available.

Construction to Control Flooding

Dikes and other structures have been built to control the occasional flooding that occurs in the Lovelock Area around the lower part of the Humboldt River. This construction began in 1906 and has continued until recent years.

Soils on the flood plain and delta are nearly level, and they have no runoff. Water from normal rains generally is absorbed as rapidly as it falls. During storms of the convection type, or thunderstorms, rainwater percolates downward into the soil or stands on the surface and evaporates.

Soils on the adjacent alluvial fans, terraces, and low foothills also lack runoff during periods of normal rainfall. Water infiltrates into these soils more slowly than it does into soils of the delta and flood plain, but it is absorbed fast enough to prevent runoff. On the other hand, a considerable amount of the rain that falls during thunderstorms runs off. Although the density of the plant cover on these upland slopes is only 5 percent or less, the amount of erosion and deposition is minor.

In most years flooding is not a problem in the Lovelock Area. Occasionally, however, the flow of the Humboldt River is exceedingly large, or water in great quantity is spilled at Rye Patch Dam because the inflow from the river is more than the reservoir can store. Then areas along the lower reaches of the river in Lower Valley are flooded.

In general, the grade of the flood plain and delta parallels the river and is fairly uniform. From northeast to southwest, the rate of decrease in elevation ranges from about 10 feet per mile in Upper Valley to 2 feet or less per mile in Lower Valley. The river flows in a deep channel through Upper Valley and the upper part of Lower Valley, but beginning about 2 miles north of Big Five Reservoir, the bed of the river is higher than the adjacent farmland to the west. In places the riverbed is as much as 6 feet above the adjoining land. Consequently, a dike was constructed to keep the river from flooding low-lying land during periods of heavy runoff. The upper 8 miles of dike were built before 1906, and the lower 4 miles were built about 1915, when the development of Lower Valley was underway. During the floods of 1945 and 1952, improvements were made on the dike by the U.S. Corps of Engineers, the Pershing County Water Conservation District, and private users of irrigation water.

Some areas in Lower Valley that are now irrigated were covered by Humboldt Lake before they were developed for irrigation; they were flooded as recently as 1906. That part of the Area rises or falls 2 feet per mile or less and slopes generally southwestward, or away from the river and toward Humboldt Lake. The level of the lake has been lowered by an outlet channel and by the control of streamflow that Rye Patch Reservoir makes possible. The outlet channel was constructed in 1915 and rehabilitated in 1945. Water from the lake drains through the outlet channel, past a geological barrier, and into Carson Sink. In years when the supply of irrigation water is normal, little if any streamflow reaches Humboldt Lake, though some water seeps back to the river channel from irrigated areas. The only other sources of water for the lake are the Army and Keys Drains.

In 1942, 1943, 1945, 1946, 1952, and other years when runoff was heavy, excess water spilled from Rye Patch Reservoir and flowed in the river channel to the lake. Each time the inflow caused the lake to rise and to discharge water through the outlet channel. During those periods, large areas would have been flooded by Humboldt Lake if the dike had not prevented it. Instead, flooding occurred only in small areas where the river breached the dike. When a large amount of water flows in the river, the dike may be breached again and, for this reason, it should be closely watched during periods of heavy runoff.

The Bureau of Reclamation, in its studies of Humboldt Lake, has established that the highest probable flood stage, or elevation of the lake surface, is 3,895 feet above sea level. During the flood of 1952, the lake rose to an elevation of 3,895.1 feet. If the flood-control dike had not been built, about 2,900 acres in the water conservation district would have been covered by water from flooding or would have been damaged by seepage. Also, the drainage of an additional 10,000 acres would have been impaired.

In 1952 the U.S. Corps of Engineers constructed an additional dike 6 miles long to prevent the lake from flooding farmland. The dike was constructed to an elevation of 3,899 feet.

Forecasts of Water Supplies

Water used for irrigation in the Lovelock Area is obtained from the Humboldt River and is stored mostly in Rye Patch Reservoir. The delivery of water to individual users is administered by the Pershing County Water Conservation District.

In some years the need for water is greater than the supply available. Although Rye Patch is a large reservoir that has a storage capacity of 179,000 acre-feet, the flow of water into the reservoir is often small. The seasonal flow and the total annual flow of the Humboldt River vary for two reasons. First, the river is fed chiefly by water from snow melting in the mountains, where the amount of precipitation may vary widely from year to year or from one series of years to another. Second, a large amount of water is diverted upstream from the reservoir to irrigate about 260,000 acres.

Although there is not enough water to meet irrigation needs in some years, farmers and ranchers of the area

obtain excellent yields of crops and generally are good irrigators. They have achieved this record by properly managing their soils, crops, and irrigation water.

In planning the management of crops and soils, farmers and ranchers are helped by forecasts of the water supply for the coming irrigation season. Estimates of the gross amount of water, in acre-feet, to be available at Rye Patch Reservoir are based on the sum of (1) the volume of water stored in the reservoir on October 1, (2) the rate of flow in the Humboldt River measured at the gaging station near Rye Patch, and (3) any increase or decrease in the amount of stored water that occurs between October 1 and the date for which the estimate is made. Estimates are needed several times each year. They can be made at any time, but those for October 1, February 1, March 1, and April 1 are especially helpful.

Because some water is lost in delivery, the total amount of water delivered to the headgates of farms and ranches is less than the gross amount stored in Rye Patch Reservoir.

Forecasts of the seasonal supply of water for irrigation can be obtained from the Pershing County Water Conservation District. These forecasts are based on the volume of water currently stored at the reservoir and an estimate of the future streamflow in the river.

Mining and Other Enterprises

Next to agriculture, mining is the most important enterprise in the Area. At the northern end of Carson Sink, several companies mine iron ore that is shipped to Japan. The ore is shipped on the Southern Pacific Railroad from Colado, about 5 miles northeast of Lovelock. Diatomaceous earth is mined from deposits about 20 miles northeast of Lovelock and is milled at a site between Colado and Lovelock. Nearby a small plant processes perlite, a form of volcanic glass. Tungsten ore, mined in the Nightingale Mining District, is milled at Toulon, about 10 miles southwest of Lovelock. These mines and mills furnish yearlong employment. In addition, some men are employed seasonally at small mines in the outlying areas, where quicksilver, lead, zinc, gold, and silver are mined.

Providing services to tourists is a new but growing part of the economy of the Area. Also, local business firms employ a number of people. The Southern Pacific Railroad employs steadily a few men as section hands and occasionally hires extra labor.

Agriculture

In the following subsections the farms and livestock of the Area are discussed.

Farms of the Area

In 1950 there were 104 farms and ranches in the Lovelock Area. Family-size farms were most numerous. The average one consisted of about 160 acres of irrigable land, including about 111 acres under cultivation. Most of these farms were operated by their owners or were leased.

Of the total farms and ranches in 1950, 25 were large ranches that averaged about 1,000 acres in size and occupied 75 percent of the total irrigable land. These ranches were owned by individuals or corporations and were operated chiefly by tenants or managers. One of the ranches contained about 9,000 irrigable acres, of which 6,000 acres were developed from dryland range. In the future some of the larger ranches may be subdivided, though irrigated farms and ranches on the Humboldt Irrigation Project are not limited to 160 acres, as are the farms on most Federal reclamation projects.

The acreage of irrigated land changes from one year to another, depending on the availability of water. In 1954, 30,648 acres were irrigated, and since 1958 an additional 1,000 acres have been brought under irrigation. In years when the supply of water is short, little or no grain is planted, but instead all the water available is used to maintain forage crops and pasture.

Livestock

Livestock, principally beef cattle, are important in the local economy. Although few beef cattle are kept all year, the valley is important as an area for feeding beef herds in winter. These animals are brought by rail or truck from Elko and Humboldt Counties. In addition, some steers are fattened on several of the larger ranches and then are marketed locally or are shipped to markets in California.

Several ranchers pasture cattle on their own land or ship them to Battle Mountain to graze for the summer. Some cattle graze on the public domain or on the national forest under grazing permits.

The valley is also a feeding area for sheep in winter. In the past transient bands of sheep wintered in the foothills and mountains that surround the valley, but these bands are no longer brought here.

Dairy cattle and poultry are generally kept to meet family needs, but they are not important commercially. Riding horses are raised to meet the needs of local ranchers, and the valley has a breeder of registered quarter horses.

Glossary

Acre-foot. The quantity of water that will cover 1 acre 1 foot deep.

Alkali soil. A soil that has so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or higher), or both, that the growth of most crop plants is reduced.

Alluvium. Soil materials deposited on land by streams.

Aquifer. A water-bearing formation through which water moves more readily than in adjacent formations of lower permeability.

Atmosphere (soils). The unit commonly used to express soil moisture tension, or the force per unit area that must be exerted to remove water from soil. One atmosphere equals 14.71 pounds per square inch.

Available water capacity. The total quantity of water that will not drain away but can be taken up by plant roots within the root zone or to a depth of 5 feet, whichever is less. The ratings are (1) *very high*, more than 12 inches; (2) *high*, 9 to 12 inches; (3) *moderate*, 6 to 9 inches; (4) *low*, 3 to 6 inches; and (5) *very low*, less than 3 inches.

Border irrigation. A method of irrigation in which the lateral surface flow of water is controlled with small earth ridges called border dikes.

Bulk density. The mass or weight of oven-dry soil per unit bulk volume, including air space.

Capillary water. The part of soil water held by cohesion as a continuous film around the particles of soil and in the capillary spaces. Most of this water is available to plants.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, magnesium, sodium, potassium, and hydrogen.

Cation-exchange capacity. A measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7) or at some other stated pH value. The term as applied to soils is synonymous with base exchange capacity but is more precise in its meaning.

Chlorosis. A condition in plants resulting from the failure of chlorophyll (the green coloring matter) to develop, generally because of deficiency of an essential nutrient. Leaves of chlorotic plants range from light green through yellow to almost white.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Some of the terms commonly used to describe consistence are—

Loose.—Noncoherent; soil does not hold together in a mass.

Friable.—When moist, soil crushes easily under gentle pressure between thumb and forefinger and can be pressed together in a lump.

Firm.—When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, soil is readily deformed by moderate pressure but can be pressed into a lump; forms a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, soil moderately resistant to pressure but is difficult to break between thumb and forefinger.

Compact.—A combination of firm consistence and close packing or arrangement of soil particles.

Cubic foot per second. A unit of flow commonly used in measuring water; a cubic foot of water moving 1 foot in 1 second. Approximately 450 gallons per minute equals 1 cubic foot per second (c.f.s.). One c.f.s. flowing 1 hour equals 1 acre-inch.

Depth, effective soil. The depth of soil material that plant roots can penetrate readily to obtain water and nutrients. It is the depth to a layer that, in physical or chemical properties, differs from the overlying material to such extent as to prevent or seriously retard the growth of roots. The depth classes are: (1) *very deep*, more than 60 inches; (2) *deep*, 36 to 60 inches; (3) *moderately deep*, 20 to 36 inches; (4) *shallow*, 10 to 20 inches; and (5) *very shallow*, 0 to 10 inches.

Drainage, soil. The rapidity and extent of the removal of water from the soil by runoff, by flow through the soil to underground spaces, or by both processes.

Runoff.—The surface flow of water from an area, or the total volume of surface flow during a specified time. The amount and rapidity of runoff is closely related to slope, and it is affected by the texture, structure, and porosity of the surface soil. The relative degrees of runoff are *ponded, very slow, slow, medium, rapid,* and *very rapid.*

Natural drainage.—Conditions of drainage that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. The following relative terms are used to express natural drainage: *excessively drained, somewhat excessively drained, well drained, moderately well drained, imperfectly or somewhat poorly drained, poorly drained,* and *very poorly drained.*

Electrical conductivity. The property of allowing transfer of electrical charge. The reciprocal of the electrical resistivity. The resistivity is the resistance in ohms of a conductor that is 1 centimeter long and has a cross-sectional area of 1 square centimeter. Hence, electrical conductivity is expressed in reciprocal ohms per centimeter, or mhos per centimeter.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Eolian deposits. Wind-deposited materials moved fairly short distances and accumulated in dunes; generally, coarse textured.

Erosion pavement. A cover of small and large rock fragments left on the surface of the soil after finer particles have been removed from surface horizons by wind.

Evapotranspiration. The loss of water from a soil by evaporation and plant transpiration.

Exchangeable sodium. Sodium that is attached to the surface of soil particles and can be replaced by calcium, magnesium, and other positively charged ions, or cations, in the soil solution.

Exchangeable-sodium percentage. The degree to which the exchange complex of the soil is saturated with sodium.

Fertility, soil. In this report, the capacity of a soil to respond to chemical and organic fertilizers. Relative terms are—

Low.—Soil has low cation-exchange capacity or is shallow and does not readily respond to plant nutrients added in large amounts.

Medium.—Soil has medium cation-exchange capacity or is moderately deep and readily responds to plant nutrients added in large amounts.

High.—Soil is deep, has high cation-exchange capacity, and readily responds to plant nutrients added in large amounts.

Field capacity. The amount of water retained in a soil after the gravitational or free water has been allowed to drain for about 24 to 36 hours; expressed as a percentage of oven-dry weight.

Flood plain. Nearly level land along streams that overflow during floods.

Furrow irrigation. A method of irrigating by using small ditches, or furrows, to apply water to crops planted in rows.

Green-manure crop. Any crop plowed under while green for the purpose of improving the soil, especially through the addition of organic matter.

Ground water. Water that fills all the unblocked pores of the material underlying the water table, which is the upper limit of saturation. It is the gravitational, or free, water in a zone of saturation. The source of water for wells and springs.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes and that differs in one or more ways from adjacent horizons in the same profile (*11*).

Infiltration. The downward entry of water into the soil. The rate of infiltration is defined as the volume of water passing into soil per unit of area per unit of time.

Intake rate. The rate, generally expressed in inches per hour, at which rain or irrigation water enters the soil. This rate is controlled partly by the infiltration rate and partly by the permeability of the subsoil. It also varies with the method of applying water.

Lacustrine deposits. Material that has been deposited in lake water and then exposed when the water level lowered or the land rose.

Leaching. The removal of material in solution by water passing through the soil.

Loam. Soil that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Moisture tension. The force at which water is held by soil, usually expressed as the equivalent of a unit column of water in centimeters; 1,000 cm. of water is equivalent to 1 atmosphere tension. Moisture tension indicates the force required to free moisture from soil particles so that it can be used by plants. The force increases with dryness.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.*

Oxidation. A chemical change in which oxygen or its chemical equivalent is added to an element or a compound.

Parent material (soil). The horizon of weathered rock or partly weathered soil material from which soil has formed.

Permeability. The quality of a soil horizon that enables water or air to move through it. The permeability classes are (1) *very slow*, less than 0.05 inch per hour; (2) *slow*, 0.05 to 0.20 inch per hour; (3) *moderately slow*, 0.20 to 0.80 inch per hour; (4) *moderate*, 0.80 to 2.50 inches per hour; (5) *moderately rapid*, 2.50 to 5.0 inches per hour; (6) *rapid*, 5.0 to 10.0 inches per hour; and (7) *very rapid*, more than 10.0 inches per hour.

pH. A numerical designation of the acidity or alkalinity of a soil. The neutral point is pH 7.0. All pH values below 7.0 indicate acidity, and all above 7.0 indicate alkalinity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Root zone. The part of the soil that is penetrated, or can be penetrated, by plant roots.

Saline soil. A soil that contains soluble salts in a quantity large enough to impair growth of crops but that does not contain excessive exchangeable sodium.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and is highly alkaline; or contains harmful salts and exchangeable sodium and is strongly alkaline. The salts, exchangeable sodium, and alkalinity occur in the soil in such location that the growth of most crops is less than normal.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Saturation extracts. The solution extracted from a soil paste that has been saturated by adding water while stirring.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Sodium-adsorption ratio. A ratio for soil extracts and irrigation water that expresses relative activity of sodium ions in exchange reactions with soil.

Structure, soil. The arrangement of primary soil particles into compound particles, or clusters, that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*blocky, columnar, granular, platy,* and *prismatic*. *Structureless* soils are *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans.

Angular blocky.—Aggregates are shaped like blocks; they may have flat or rounded surfaces that join at sharp angles.

Subangular blocky.—Aggregates have some rounded and some flat surfaces; upper sides are rounded.

Columnar.—Aggregates are prismatic and are rounded at the top.

Granular.—Aggregates are roughly spherical, small, and relatively nonporous, but they do not have the distinct faces of blocky structure.

Platy.—Aggregates are flaky or platelike.

Prismatic.—Aggregates have flat vertical surfaces, and their height is greater than their width.

Subsoil. In many soils, the B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer beneath the solum, or true soil. It applies to the parent material and to layers unlike the parent material that lie below the B horizon, or subsoil.

Terrace (geology). A nearly level or undulating plain that commonly is rather narrow, generally has a steep front, and borders a river, a lake, or the sea.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water quality. A classification of irrigation water based on the electrical conductivity and the sodium-adsorption ratio. Described in terms of *excellent, good, fair,* and *poor.*

Water table, main. The upper surface of free ground water below which all pores are completely filled with water.

Water table, perched. The upper surface of a body of free ground water that is separated from an underlying body of ground water by unsaturated material.

Wilting point (soils). The moisture, stated in percentage of dry weight, that remains in the soil when plants have wilted to the point that they will not revive if placed in a saturated atmosphere.

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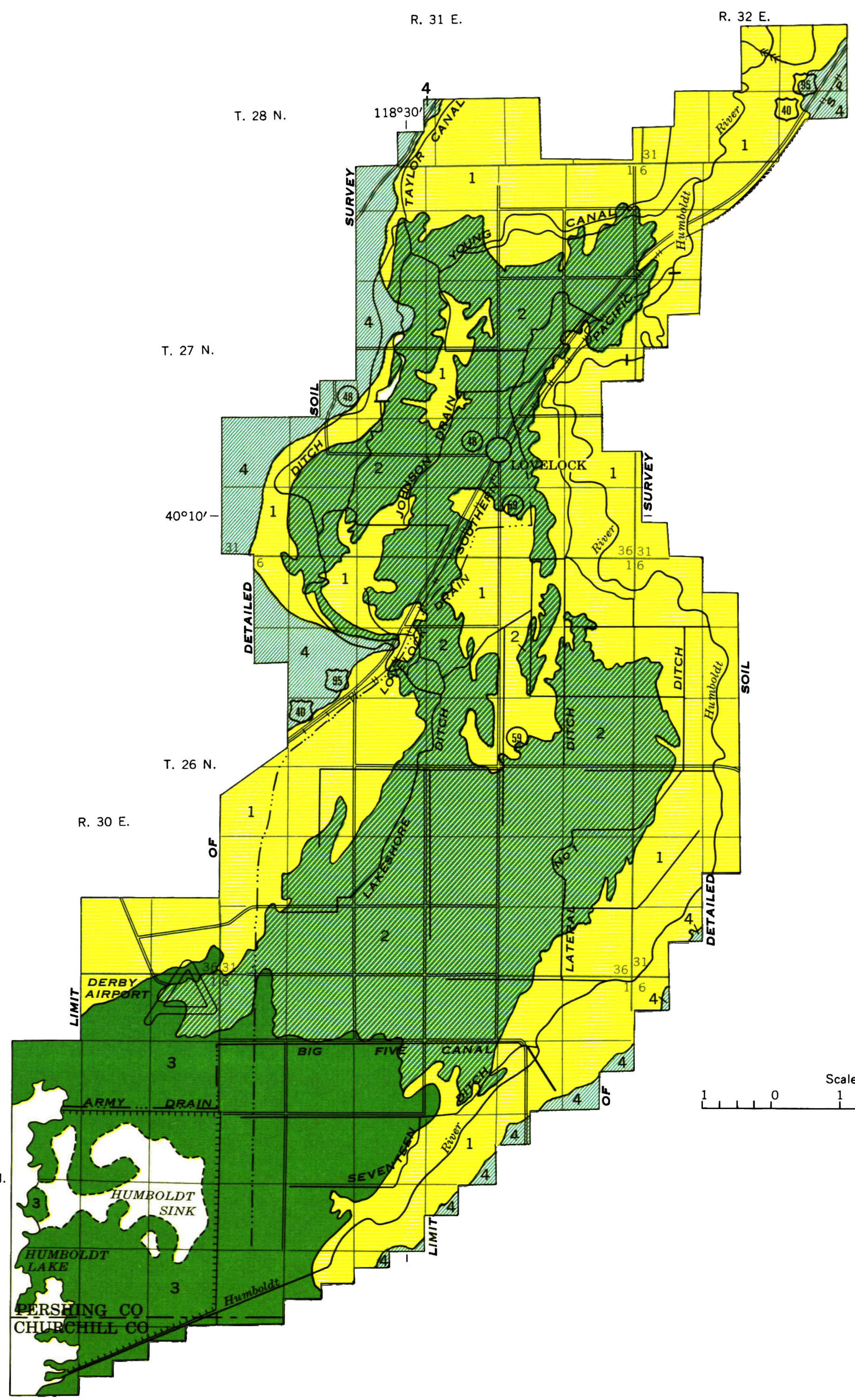
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

UNIVERSITY OF NEVADA
AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
LOVELOCK AREA, NEVADA



Scale 1:126,720

1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1 Sonoma-Placeritos association: Light-colored, very deep, imperfectly drained soils on the nearly level flood plain of the Humboldt River

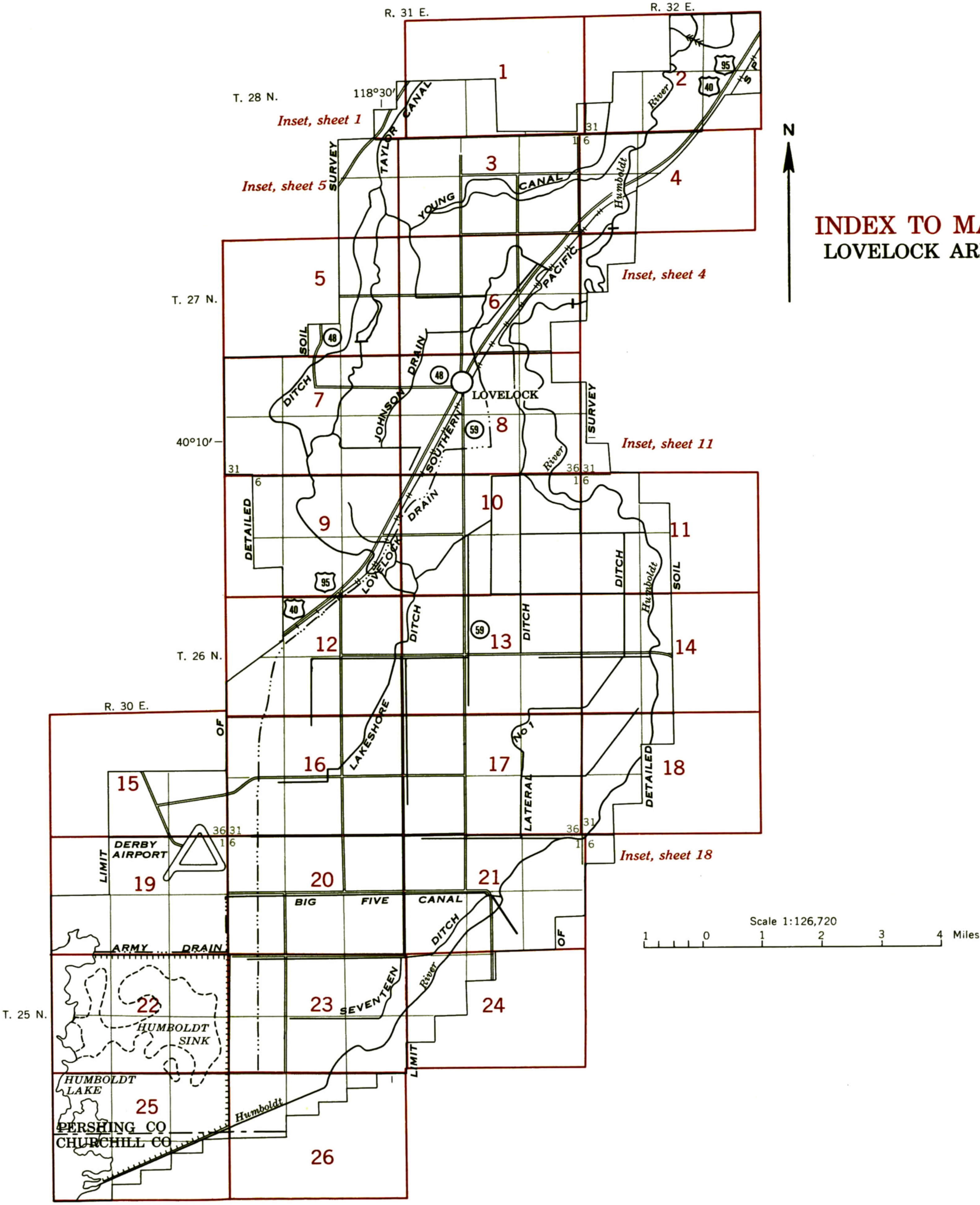
2 Humboldt-Ryepatch association: Dark-colored, very deep, imperfectly drained soils on the nearly level flood plain and upper delta of the Humboldt River

3 Lovelock-Kodak association: Very deep, level and nearly level, poorly drained and imperfectly drained soils on the lower delta of the Humboldt River and the old bed of Humboldt Lake

4 Mazuma-Unionville association: Nearly level to sloping, very deep and moderately deep, well-drained soils on terraces, alluvial fans, and foothills

April 1964

INDEX TO MAP SHEETS
LOVELOCK AREA, NEVADA



CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries

Mine dump

Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Oil wells

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant
- Project area

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches — CANAL, DITCH

Lakes and ponds
- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

Flume

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Sand dunes
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, or D, shows the slope. Symbols without a slope letter are for nearly level soils, such as Humboldt silt loam.

SYMBOL	NAME
BgC	Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes
BlC	Bluewing gravelly fine sandy loam, 2 to 8 percent slopes
BtB	Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes
Ha	Humboldt silt loam
Hb	Humboldt silt loam, drained
Hc	Humboldt silt loam, slightly saline-alkali
Hd	Humboldt silt loam, strongly saline-alkali
He	Humboldt silt loam, drained, strongly saline-alkali
Hf	Humboldt silt loam, moderately coarse substratum
Hg	Humboldt silt loam, moderately coarse substratum, slightly saline-alkali
Hh	Humboldt silt loam, moderately coarse substratum, strongly saline-alkali
Hi	Humboldt silt loam, moderately deep over clay
Hk	Humboldt silt loam, moderately deep over clay, drained
Hl	Humboldt silt loam, moderately deep over clay, slightly saline-alkali
Hm	Humboldt silt loam, moderately deep over clay, strongly saline-alkali
Hn	Humboldt silt loam, shallow over clay
Ho	Humboldt silt loam, shallow over clay, drained
Hp	Humboldt silt loam, shallow over clay, slightly saline-alkali
Hq	Humboldt silt loam, shallow over clay, strongly saline-alkali
Hr	Humboldt silty clay
Hs	Humboldt silty clay, drained
Ht	Humboldt silty clay, slightly saline-alkali
Hu	Humboldt silty clay, strongly saline-alkali
Hv	Humboldt silty clay, moderately deep over clay
Hw	Humboldt silty clay, moderately deep over clay, slightly saline-alkali
Hx	Humboldt silty clay, shallow over clay
Hy	Humboldt silty clay, shallow over clay, slightly saline-alkali
Hz	Humboldt silty clay, shallow over clay, strongly saline-alkali
Ko	Kodak loamy fine sand, moderately deep
La	Lahontan fine sandy loam, sandy variant, strongly saline-alkali
Lb	Lahontan silt loam, strongly saline-alkali
Lc	Lahontan silty clay loam, strongly saline-alkali
Ld	Lovelock silt loam, drained
Lf	Lovelock silt loam, slightly saline
Lg	Lovelock silt loam, strongly saline
Lh	Lovelock silt loam, hummocky, strongly saline
Lk	Lovelock silt loam, occasionally flooded, strongly saline
Lm	Lovelock silt loam, overwashed, strongly saline
Ln	Lovelock silt loam, moderately deep over clay, drained
Lo	Lovelock silt loam, moderately deep over clay, drained, slightly saline
Lp	Lovelock silt loam, shallow over clay, drained
Lr	Lovelock silt loam, shallow over clay, strongly saline
Ls	Lovelock silt loam, hummocky, shallow over clay, strongly saline
MaA	Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes
McA	Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes
MgC	Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes
Om	Ocala loam, strongly saline-alkali
Pa	Placeritos loam
Pd	Placeritos loam, drained
Pf	Placeritos loam, slightly saline-alkali
Pg	Placeritos loam, strongly saline-alkali
Ph	Placeritos loam, drained, strongly saline-alkali
Pk	Placeritos loam, over clay, drained, strongly saline-alkali
Pm	Placeritos loam, over silty clay loam, slightly saline-alkali
Pn	Placeritos loam, over silty clay loam, drained, strongly saline-alkali
Po	Placeritos loam, over sand
Pp	Placeritos loam, over sand, slightly saline-alkali
Pr	Placeritos loam, over sand, strongly saline-alkali
Ps	Placeritos loam, terrace, strongly saline-alkali
QfD	Quincy fine sand, 0 to 15 percent slopes
QtA	Quincy fine sand, over silty clay loam, 0 to 2 percent slopes
Ra	Ryepatch silty clay
Rd	Ryepatch silty clay, drained
Rh	Ryepatch silty clay, slightly saline-alkali
Rp	Ryepatch silty clay loam
Rs	Ryepatch silty clay loam, drained
Rt	Ryepatch silty clay loam, slightly saline-alkali
Ry	Ryepatch silty clay loam, strongly saline-alkali
Sa	Sandy alluvial land
Sm	Sonoma silt loam
Sn	Sonoma silt loam, drained
So	Sonoma silt loam, slightly saline-alkali
Sp	Sonoma silt loam, strongly saline-alkali
Sr	Sonoma silt loam, drained, strongly saline-alkali
Ss	Sonoma silt loam, over clay, slightly saline-alkali
St	Sonoma silt loam, over clay, strongly saline-alkali
Sv	Sonoma silty clay loam
Sw	Sonoma silty clay loam, drained
Sx	Sonoma silty clay loam, slightly saline-alkali
Sy	Sonoma silty clay loam, strongly saline-alkali
TgB	Toulon very gravelly loam, 0 to 4 percent slopes
To	Toy silty clay, strongly saline-alkali
Ty	Toy silty clay loam, strongly saline-alkali
UnC	Unionville very rocky coarse sandy loam, 4 to 8 percent slopes
WoC	Woolsey gravelly fine sandy loam, 2 to 8 percent slopes

Soil map constructed 1963 by Cartographic Division, Soil Conservation Service, USDA from 1946 and 1947 aerial photographs. Controlled mosaic based on Nevada plane coordinate system, transverse Mercator projection. 1927 North American datum.

GUIDE TO MAPPING UNITS

[See table 1, p. 4, for approximate acreage and proportionate extent of the soils, and table 7 for estimated yields p. 44. See pp. 48 to 62 for information on engineering properties of the soils. Dashes indicate that mapping unit was not placed in a range site, because it is used for cultivated crops and not for range]

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Range site Name	Range site Page
BgC	Bluewing gravelly loamy coarse sand, 2 to 8 percent slopes	4	VIIs-4	43	Desert Uplands	47
BlC	Bluewing gravelly fine sandy loam, 2 to 8 percent slopes	6	VIIs-4	43	Desert Uplands	47
BtB	Bluewing very gravelly loam, over tufa, 0 to 4 percent slopes	6	VIIs-4	43	Desert Uplands	47
Ha	Humboldt silt loam	7	IIw-2	37	------------------	--
Hb	Humboldt silt loam, drained	7	IIw-2	37	------------------	--
Hc	Humboldt silt loam, slightly saline-alkali	7	IIw-6	38	------------------	--
Hd	Humboldt silt loam, strongly saline-alkali	7	VIIw-6	43	Alkali Flats	46
He	Humboldt silt loam, drained, strongly saline-alkali	8	VIIs-6	43	Alkali Flats	46
Hf	Humboldt silt loam, moderately coarse substratum	8	IIw-2	37	------------------	--
Hg	Humboldt silt loam, moderately coarse substratum, slightly saline-alkali	8	IIw-6	38	------------------	--
Hh	Humboldt silt loam, moderately coarse substratum, strongly saline-alkali	9	VIIw-6	43	Alkali Flats	46
Hi	Humboldt silt loam, moderately deep over clay	9	IIw-3	37	------------------	--
Hk	Humboldt silt loam, moderately deep over clay, drained	9	IIw-3	37	------------------	--
Hl	Humboldt silt loam, moderately deep over clay, slightly saline-alkali	9	IIIw-36	39	------------------	--
Hm	Humboldt silt loam, moderately deep over clay, strongly saline-alkali	9	VIIw-6	43	Alkali Flats	46
Hn	Humboldt silt loam, shallow over clay	10	IIw-3	37	------------------	--
Ho	Humboldt silt loam, shallow over clay, drained	10	IIw-3	37	------------------	--
Hp	Humboldt silt loam, shallow over clay, slightly saline-alkali	10	IIIw-36	39	------------------	--
Hq	Humboldt silt loam, shallow over clay, strongly saline-alkali	10	VIIw-6	43	Alkali Flats	46
Hr	Humboldt silty clay	6	IIw-5	38	------------------	--
Hs	Humboldt silty clay, drained	8	IIw-5	38	------------------	--
Ht	Humboldt silty clay, slightly saline-alkali	8	IIIw-56	40	------------------	--
Hu	Humboldt silty clay, strongly saline-alkali	8	VIIw-6	43	Alkali Flats	46
Hv	Humboldt silty clay, moderately deep over clay	9	IIw-35	37	------------------	--
Hw	Humboldt silty clay, moderately deep over clay, slightly saline-alkali	10	IIIw-356	39	------------------	--
Hx	Humboldt silty clay, shallow over clay	10	IIw-35	37	------------------	--
Hy	Humboldt silty clay, shallow over clay, slightly saline-alkali	10	IIIw-356	39	------------------	--
Hz	Humboldt silty clay, shallow over clay, strongly saline-alkali	11	VIIw-6	43	Alkali Flats	46
Ko	Kodak loamy fine sand, moderately deep	11	VIIw-6	43	Alkali Flats	46
La	Lahontan fine sandy loam, sandy variant, strongly saline-alkali	12	VIIw-6	43	Alkali Flats	46
Lb	Lahontan silt loam, strongly saline-alkali	12	VIIw-6	43	Alkali Flats	46
Lc	Lahontan silty clay loam, strongly saline-alkali	11	VIIw-6	43	Alkali Flats	46
Ld	Lovelock silt loam, drained	12	IIw-0	38	------------------	--
Lf	Lovelock silt loam, slightly saline	13	IIIw-06	41	------------------	--
Lg	Lovelock silt loam, strongly saline	14	VIw-6	43	Wet Saline Bottoms	46
Lh	Lovelock silt loam, hummocky, strongly saline	13	VIw-6	43	Wet Saline Bottoms	46
Lk	Lovelock silt loam, occasionally flooded, strongly saline	13	VIw-6	43	Wet Saline Bottoms	46
Lm	Lovelock silt loam, overwashed, strongly saline	13	VIw-6	43	Wet Saline Bottoms	46
Ln	Lovelock silt loam, moderately deep over clay, drained	15	IIw-03	39	------------------	--
Lo	Lovelock silt loam, moderately deep over clay, drained, slightly saline	15	IIIw-036	41	------------------	--
Lp	Lovelock silt loam, shallow over clay, drained	14	IIw-03	39	------------------	--
Lr	Lovelock silt loam, shallow over clay, strongly saline	14	VIw-6	43	Wet Saline Bottoms	46
Ls	Lovelock silt loam, hummocky, shallow over clay, strongly saline	14	VIw-6	43	Wet Saline Bottoms	46
MaA	Mazuma fine sandy loam, strongly saline-alkali, 0 to 2 percent slopes	15	VIIs-6	43	Alkali Flats	46
McA	Mazuma fine sandy loam, over clay, strongly saline-alkali, 0 to 2 percent slopes	15	VIIs-6	43	Alkali Flats	46
MgC	Mazuma fine sandy loam, over gravel, 4 to 8 percent slopes	16	VIIs-4	43	Desert Uplands	47
Om	Ocala loam, strongly saline-alkali	16	VIw-6	43	Wet Saline Bottoms	46
Pa	Placeritos loam	17	IIw-2	37	------------------	--
Pd	Placeritos loam, drained	17	(1/)	--	Desert Uplands	47
Pf	Placeritos loam, slightly saline-alkali	17	IIw-6	38	------------------	--
Pg	Placeritos loam, strongly saline-alkali	17	VIIw-6	43	Alkali Flats	46
Ph	Placeritos loam, drained, strongly saline-alkali	18	VIIs-6	43	Alkali Flats	46
Pk	Placeritos loam, over clay, drained, strongly saline-alkali	18	VIIs-6	43	Alkali Flats	46
Pm	Placeritos loam, over silty clay loam, slightly saline-alkali	19	IIw-6	38	------------------	--
Pn	Placeritos loam, over silty clay loam, drained, strongly saline-alkali	19	VIIs-6	43	Alkali Flats	46
Po	Placeritos loam, over sand	18	IIIw-4	40	------------------	--
Pp	Placeritos loam, over sand, slightly saline-alkali	18	IIIw-46	40	------------------	--
Pr	Placeritos loam, over sand, strongly saline-alkali	18	VIIw-6	43	Alkali Flats	46
Ps	Placeritos loam, terrace, strongly saline-alkali	19	VIIs-6	43	Alkali Flats	46
QfD	Quincy fine sand, 0 to 15 percent slopes	20	VIIs-L	43	Sand Hills	47
QtA	Quincy fine sand, over silty clay loam, 0 to 2 percent slopes	20	IIIs-L	41	------------------	--
Ra	Ryepatch silty clay	20	IIw-35	37	------------------	--
Rd	Ryepatch silty clay, drained	21	IIw-35	37	------------------	--
Rh	Ryepatch silty clay, slightly saline-alkali	21	IIIw-356	39	------------------	--
Rp	Ryepatch silty clay loam	21	IIw-3	37	------------------	--
Rs	Ryepatch silty clay loam, drained	21	IIw-3	37	------------------	--
Rt	Ryepatch silty clay loam, slightly saline-alkali	21	IIIw-36	39	------------------	--
Ry	Ryepatch silty clay loam, strongly saline-alkali	21	VIIw-6	43	Alkali Flats	46
Sa	Sandy alluvial land	22	VIw-6	43	Wet Saline Bottoms	46
Sm	Sonoma silt loam	23	IIw-2	37	------------------	--
Sn	Sonoma silt loam, drained	23	IIw-2	37	------------------	--
So	Sonoma silt loam, slightly saline-alkali	23	IIw-6	38	------------------	--
Sp	Sonoma silt loam, strongly saline-alkali	23	VIIw-6	43	Alkali Flats	46
Sr	Sonoma silt loam, drained, strongly saline-alkali	23	VIIs-6	43	Alkali Flats	46
Ss	Sonoma silt loam, over clay, slightly saline-alkali	24	IIIw-36	39	------------------	--
St	Sonoma silt loam, over clay, strongly saline-alkali	24	VIIw-6	43	Alkali Flats	46
Sv	Sonoma silty clay loam	22	IIw-2	37	------------------	--
Sw	Sonoma silty clay loam, drained	24	IIw-2	37	------------------	--
Sx	Sonoma silty clay loam, slightly saline-alkali	24	IIw-6	38	------------------	--
Sy	Sonoma silty clay loam, strongly saline-alkali	24	VIIw-6	43	Alkali Flats	46
TgB	Toulon very gravelly loam, 0 to 4 percent slopes	25	VIIIs-4	43	------------------	--
To	Toy silty clay, strongly saline-alkali	26	IVw-356	42	------------------	--
Ty	Toy silty clay loam, strongly saline-alkali	25	IVw-36	42	------------------	--
UnC	Unionville very rocky coarse sandy loam, 4 to 8 percent slopes	26	VIIs-4	43	Desert Uplands	47
WoC	Woolsey gravelly fine sandy loam, 2 to 8 percent slopes	27	VIIc-K	43	Desert Uplands	47

1/ Placeritos loam, drained, is in capability units I-A, irrigated, p. 37 and VIIc-K, nonirrigated, p. 43.

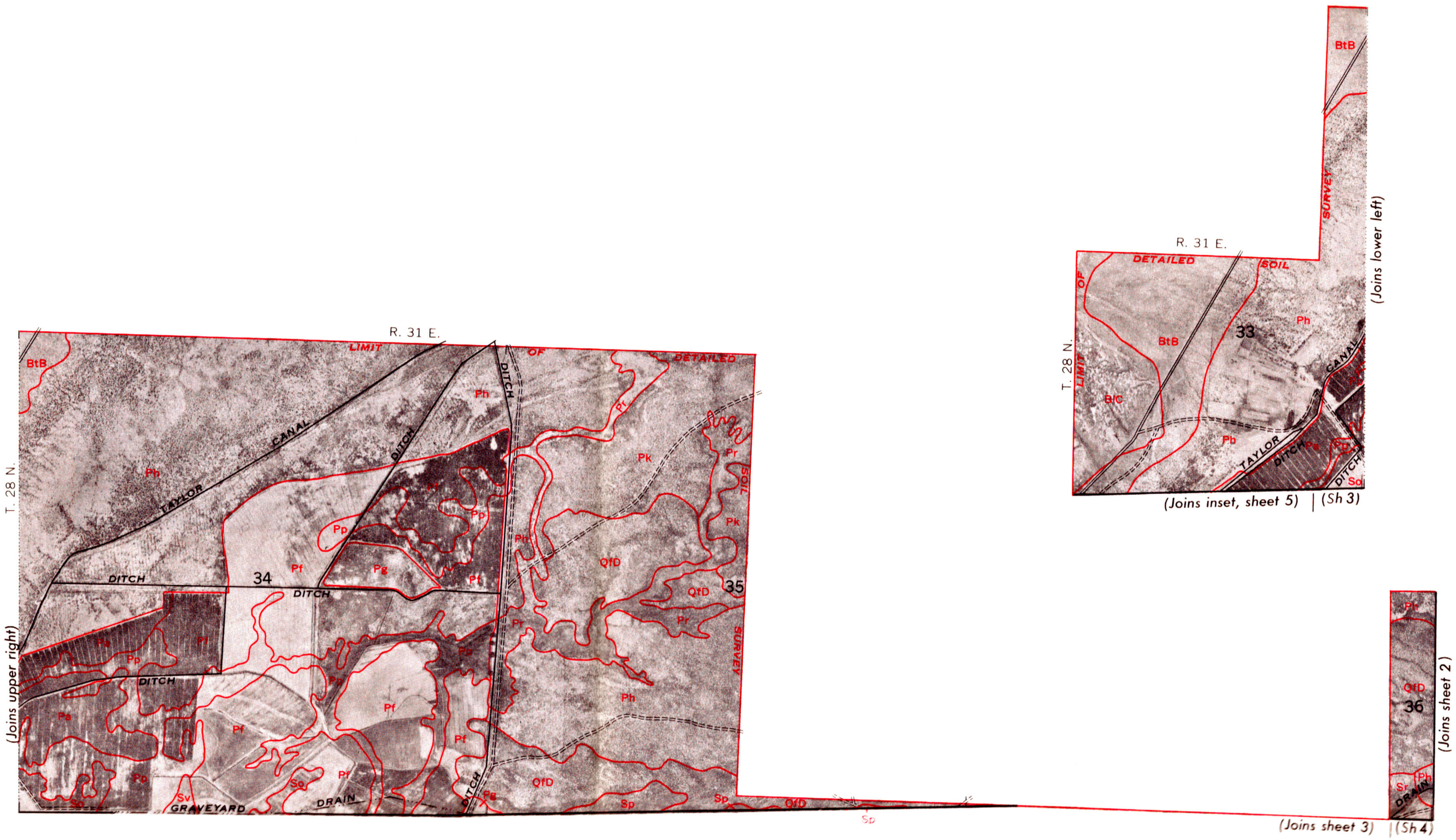
730-494 O - 65 (Face blank p. 88)

1

N

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Nevada Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

(2)

0 ½ Mile

Scale 1:15840

0 3000 Feet

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0 ½ Mile Scale 1:15840 0 3000 Feet

4

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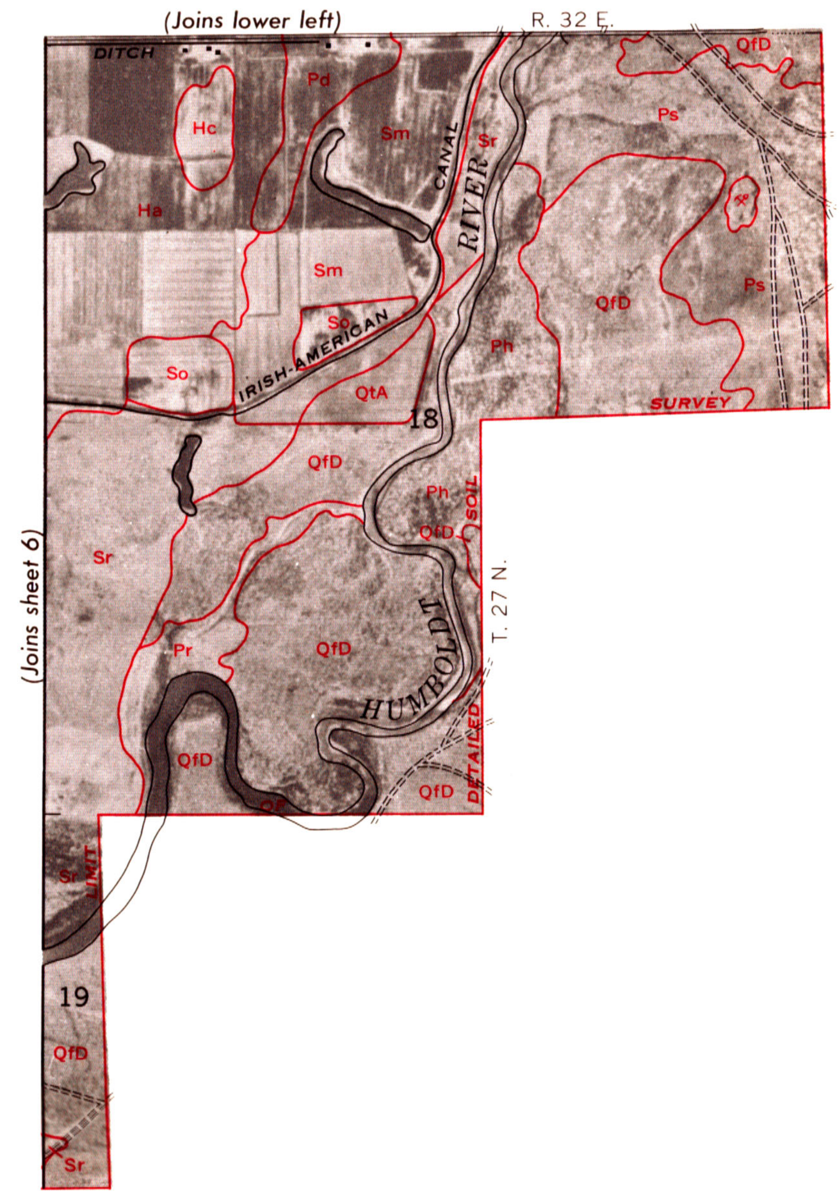

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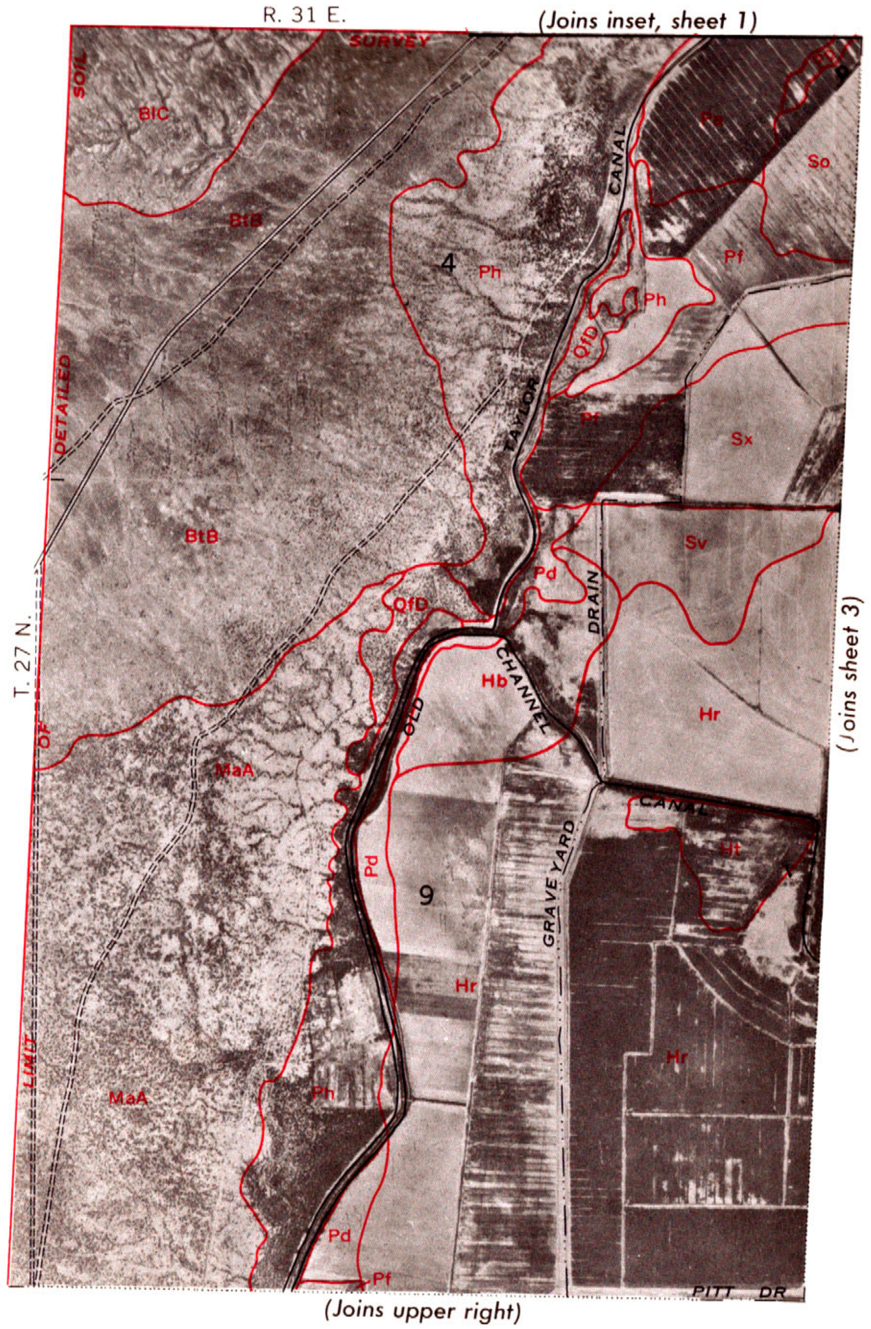

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N

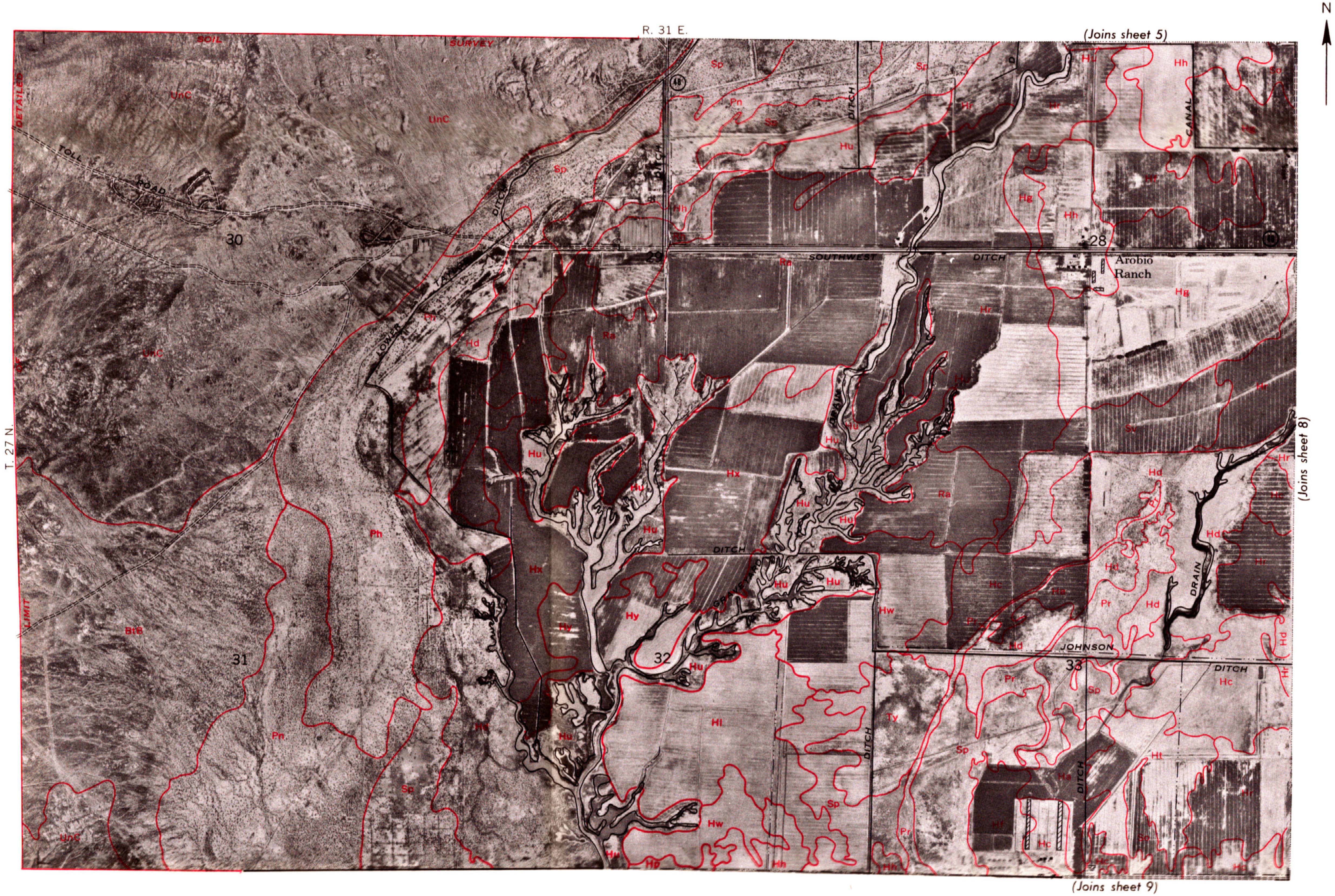
0 ½ Mile

Scale 1:15840

0 3000 Feet

6


N
(Joins sheet 3)
R. 31 E.
(Joins sheet 5)
(Joins inset, sheet 4)
(Joins sheet 8)
T. 27 N.
FAIRVIEW ROAD
NUMBER 11 LATERAL DITCH
LITTLE LOVELOCK DITCH
LOORZ ROAD
SOUTHWEST CANAL
DRAIN
UPPER VALLEY
SOUTHERN PACIFIC
UNION CANAL
IRISH AMERICAN DITCH
PITT ROAD
MERIDIAN ROAD
NORTH
JOHNSON DRAIN
RUDDELL DITCH
SOUTHWEST MEADOW
BIG CANAL
HUMBOLDT RIVER
ROGERS DAM
ROGERS CANAL
SURVEY
LIMIT OF DETAILED SOIL
Lovelock Airport (abandoned)
AIRPORT ROAD
15
14
13
22
23
24
0
½ Mile
Scale 1:15840
0
3000 Feet



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0 ½ Mile Scale 1:15840 0 3000 Feet

8

½ Mile
Scale 1:15840
0
3000 Feet

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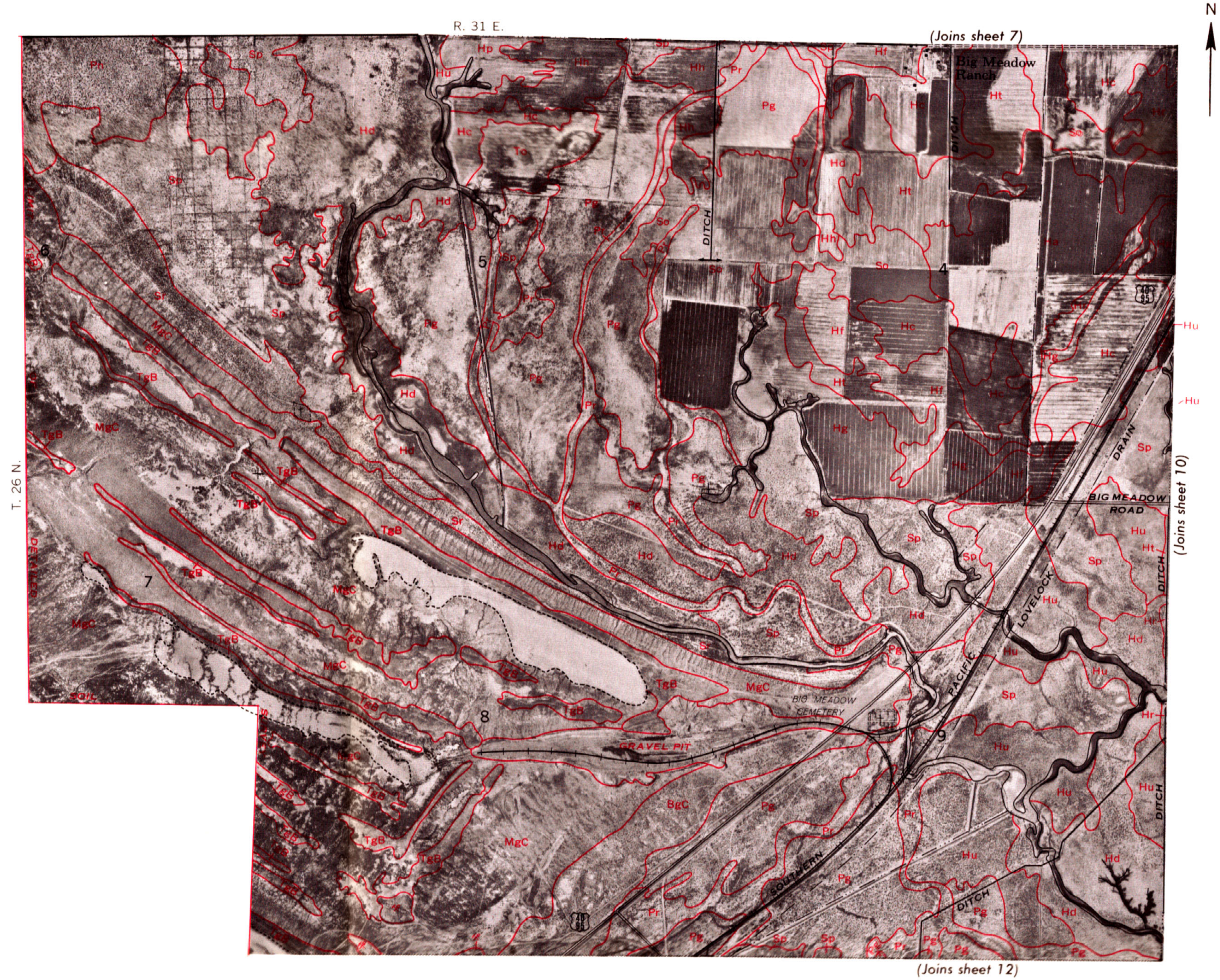


0 ½ Mile

Scale 1:15840

0 3000 Feet

N

(Joins sheet 8)

R. 31 E.

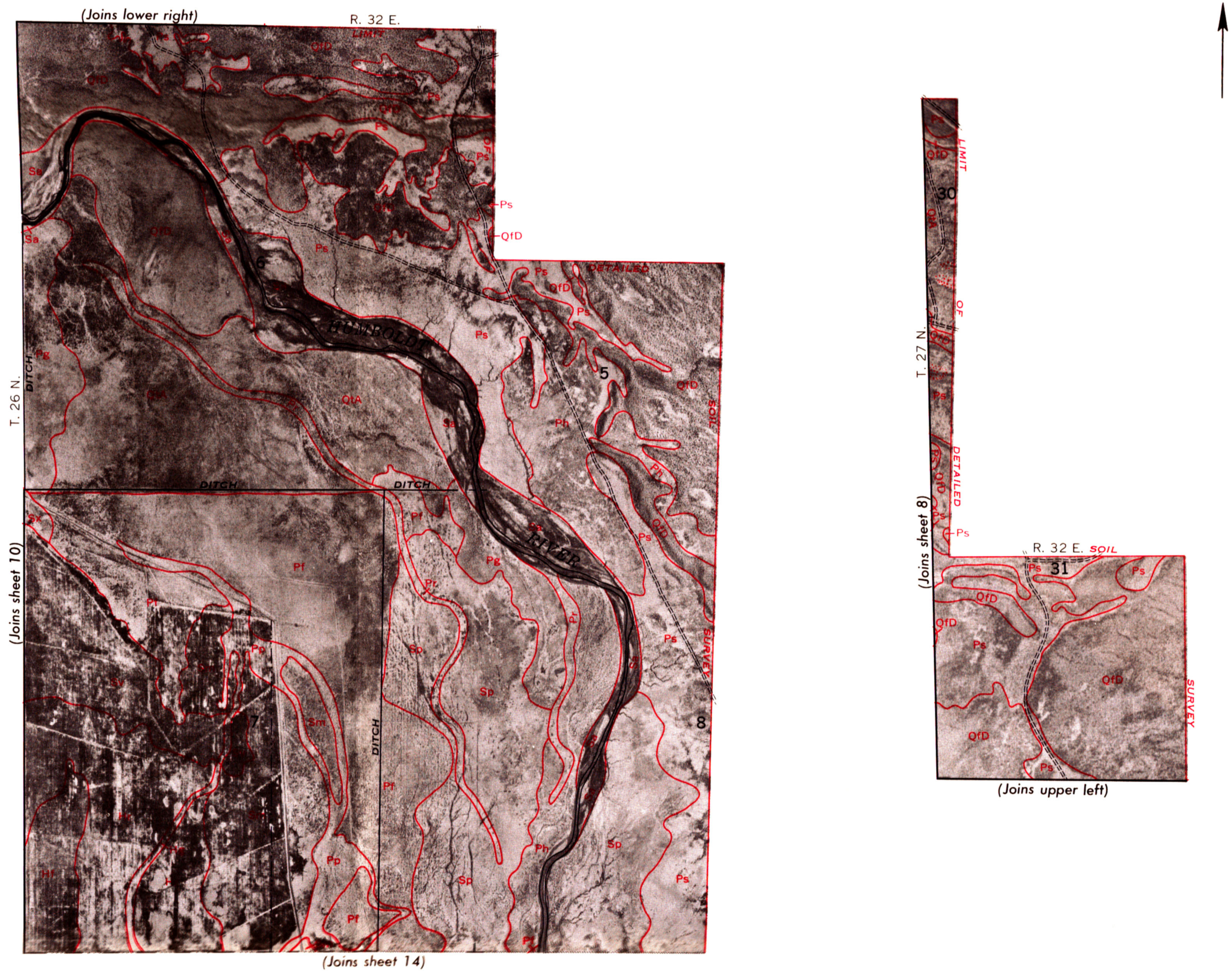
(Joins sheet 9)

T. 26 N.

(Joins sheet 11)

(Joins sheet 13)

0 ½ Mile Scale 1:15840 0 3000 Feet



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Range, township, and section corners shown on this map are indefinite.

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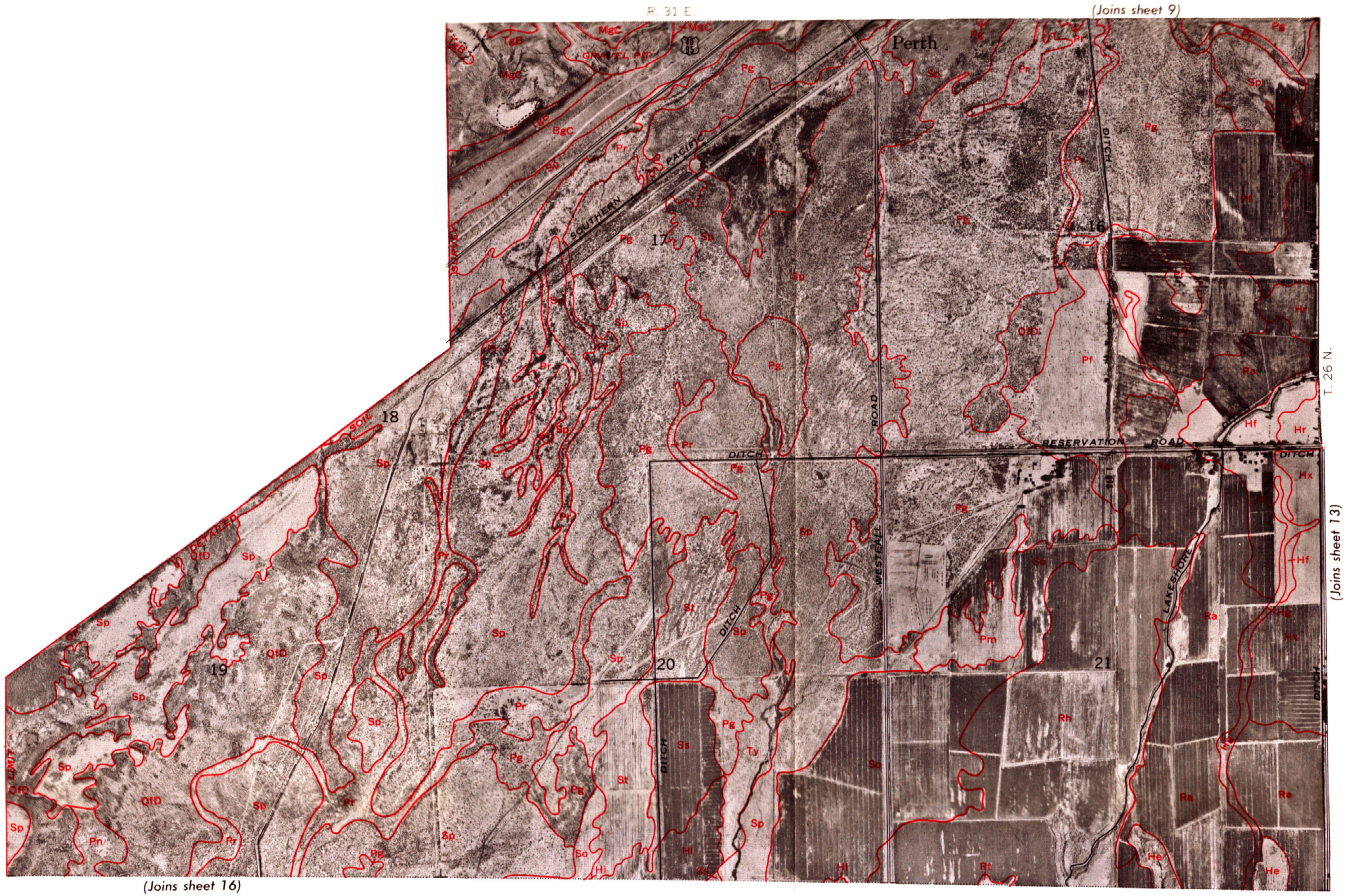

0 ½ Mile Scale 1:15840 0 3000 Feet

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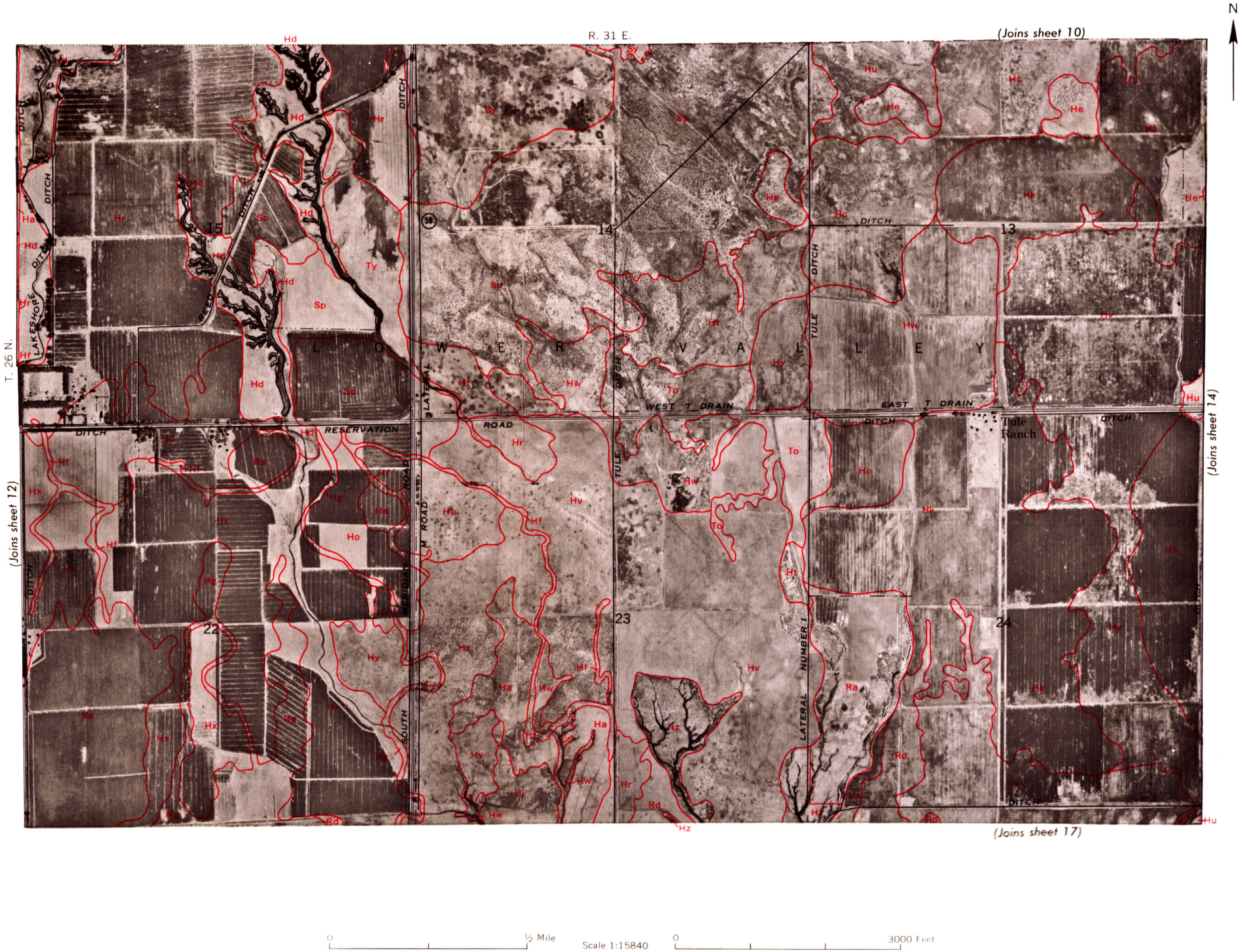

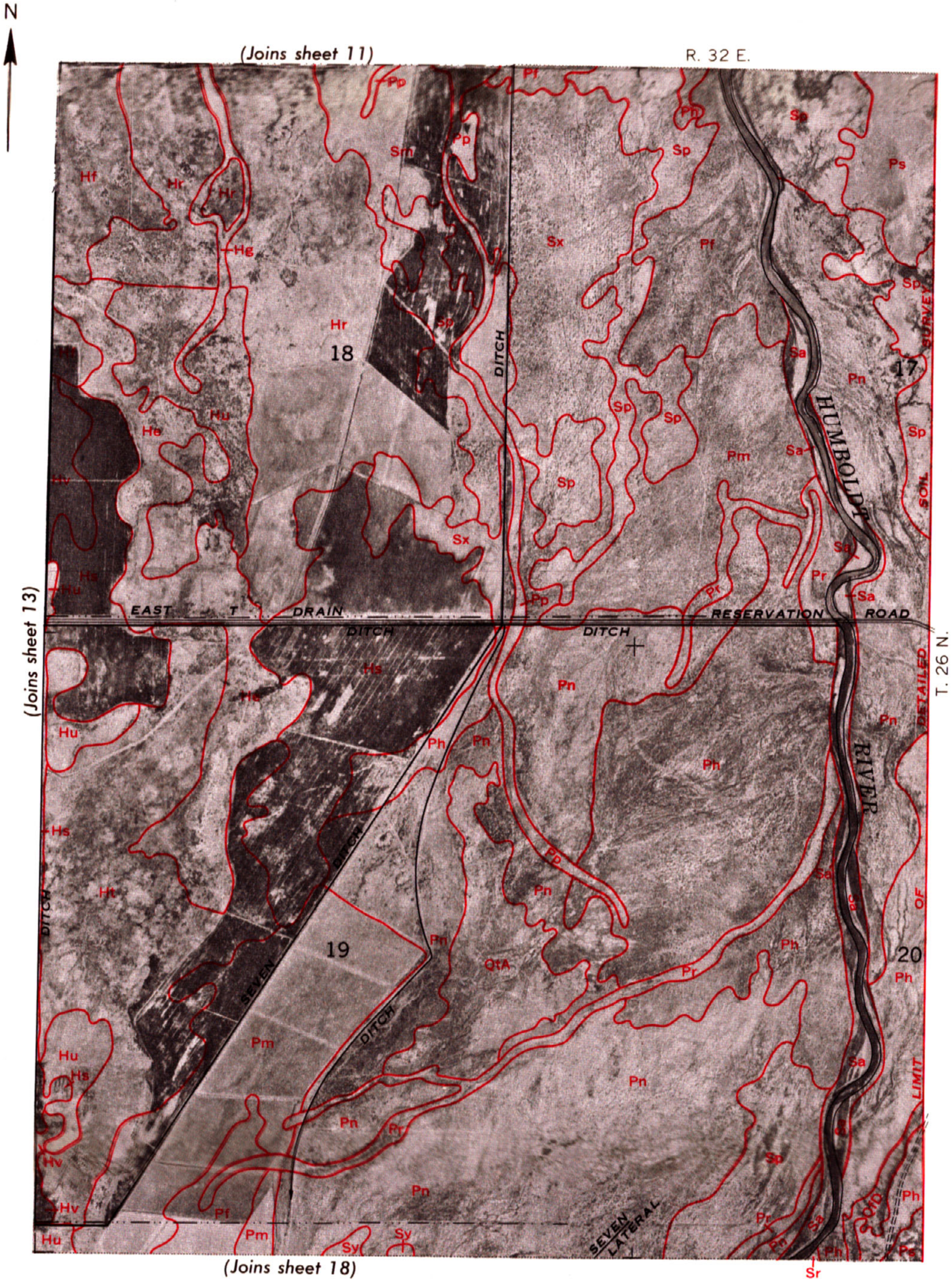

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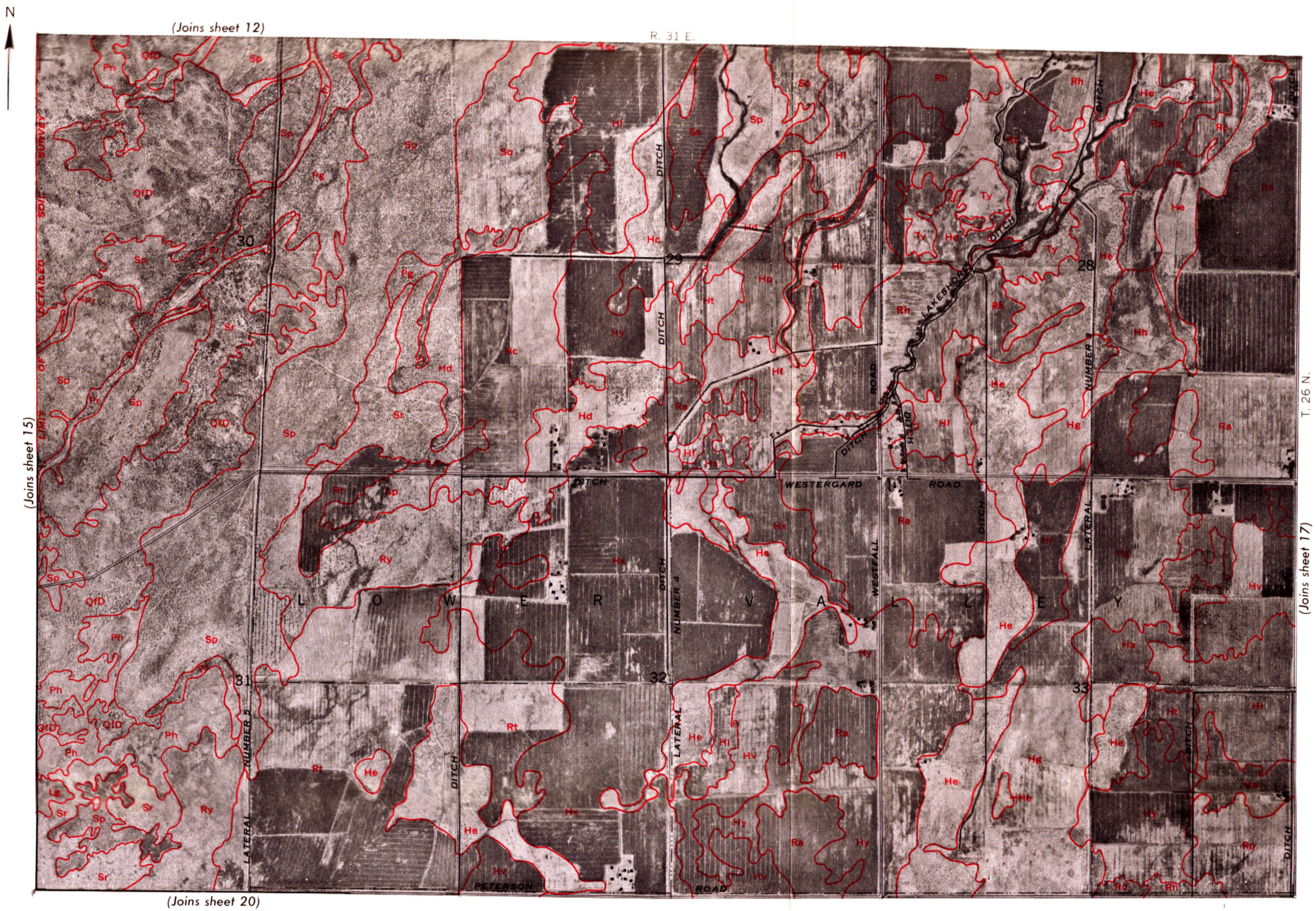
0 ½ Mile Scale 1:15840 0 3000 Feet

LOVELOCK AREA, NEVADA — SHEET NUMBER 16



0 ½ Mile Scale 1:15840 0 3000 Feet

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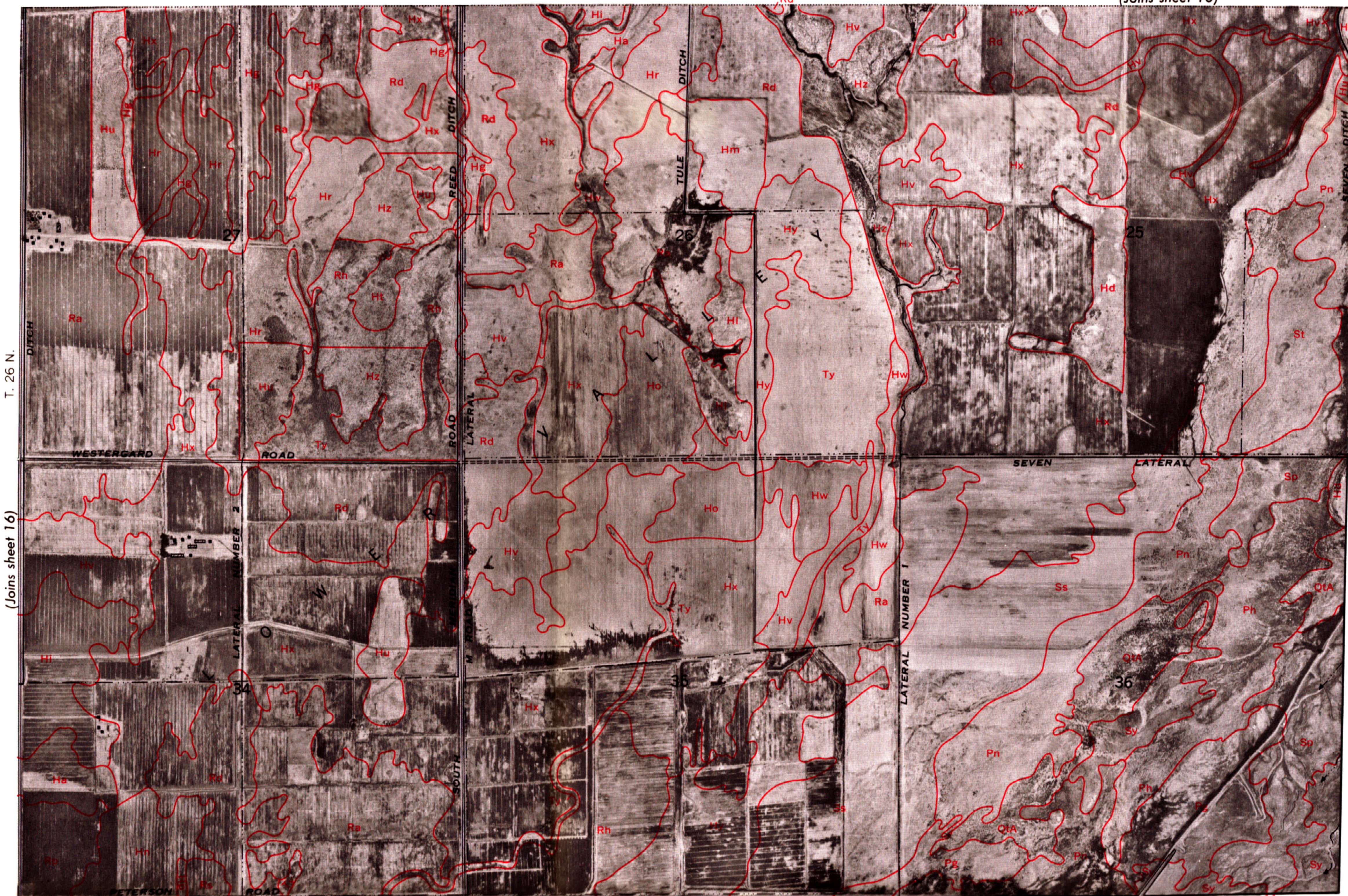
N

R. 31 E.

(Joins sheet 13)

T. 26 N.

(Joins sheet 16)



(Joins sheet 18)

(Joins sheet 21)

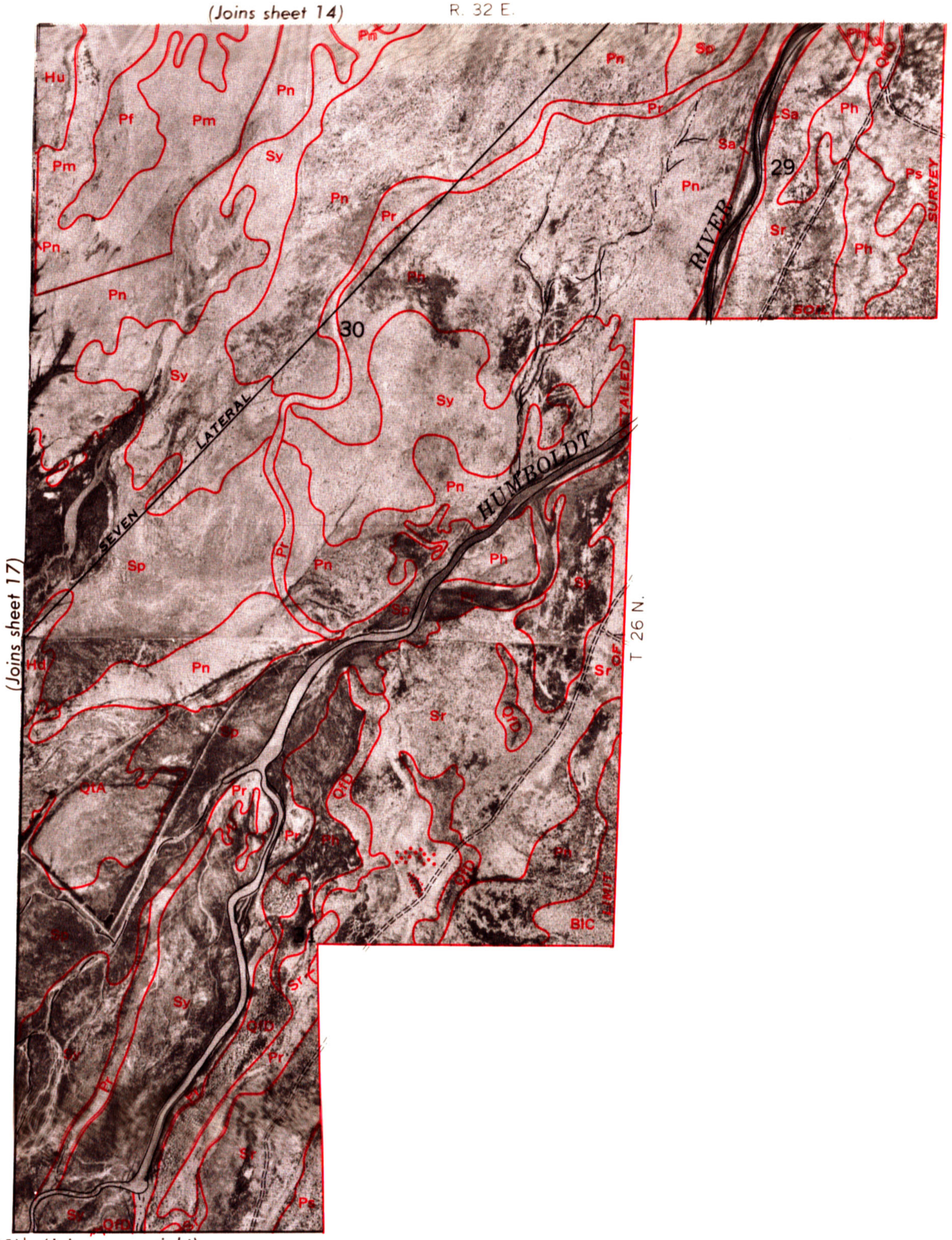
0 ½ Mile

Scale 1:15840

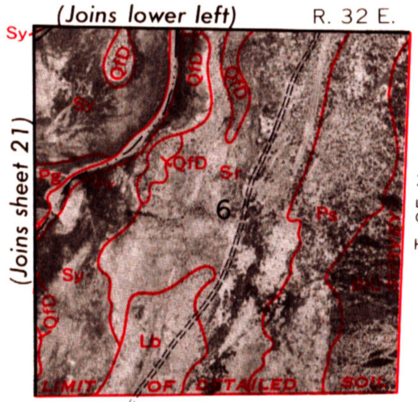
0 3000 Feet

N

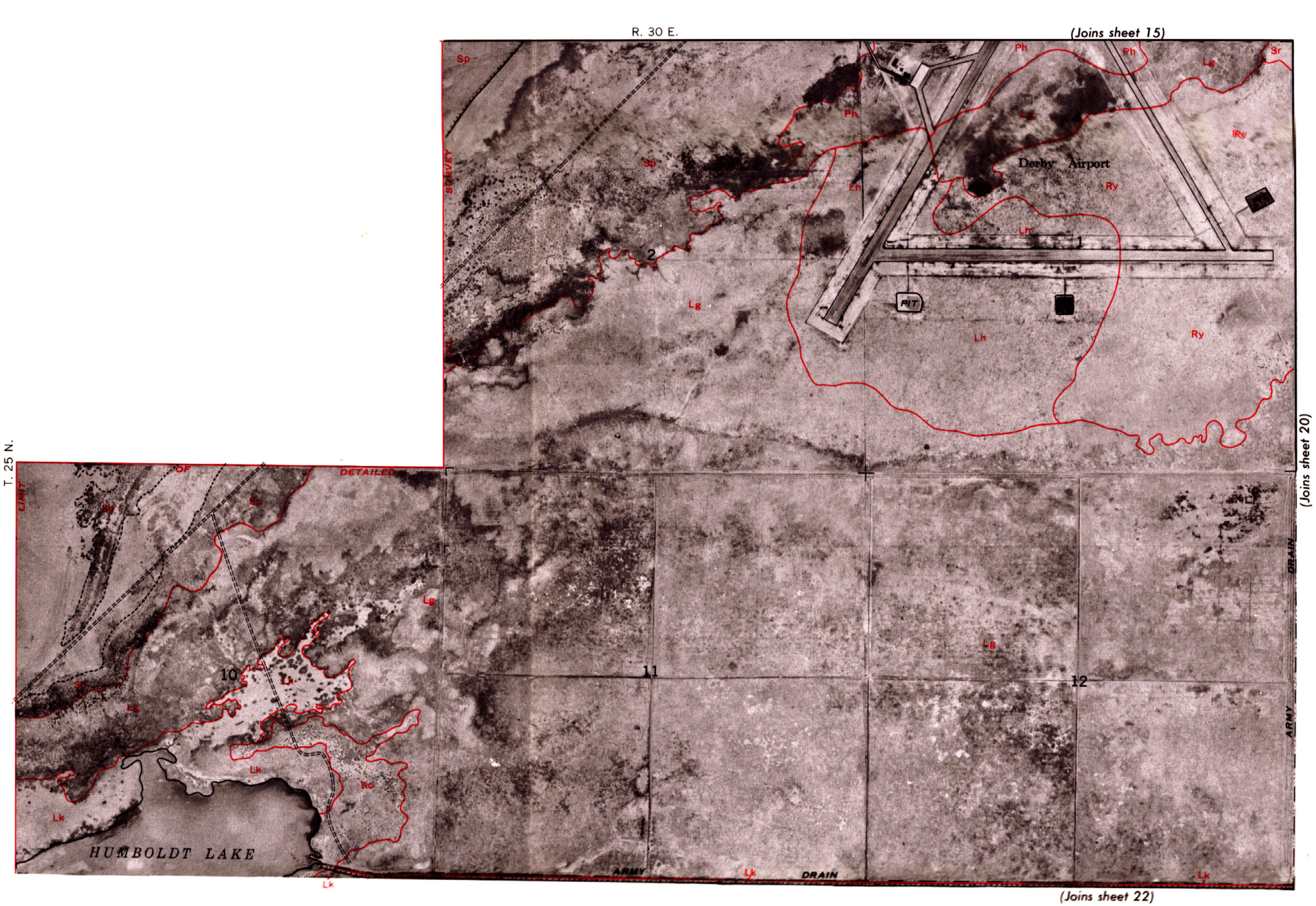
(Joins sheet 14) R. 32 E.



(Joins lower left) R. 32 E.



0 ½ Mile Scale 1:15840 0 3000 Feet



This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the University of Nevada Agricultural Experiment Station.

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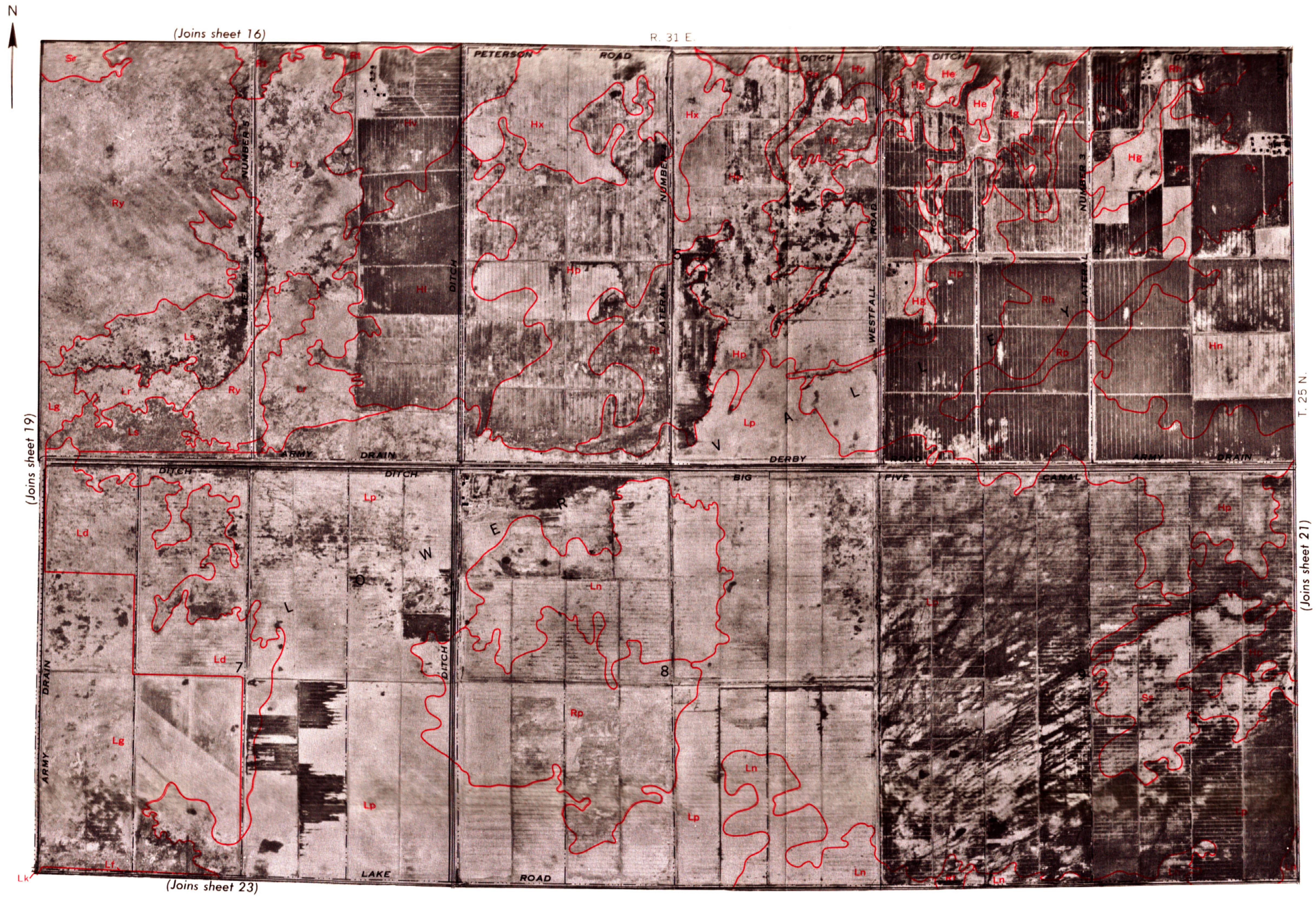
0 ½ Mile Scale 1:15840 0 3000 Feet



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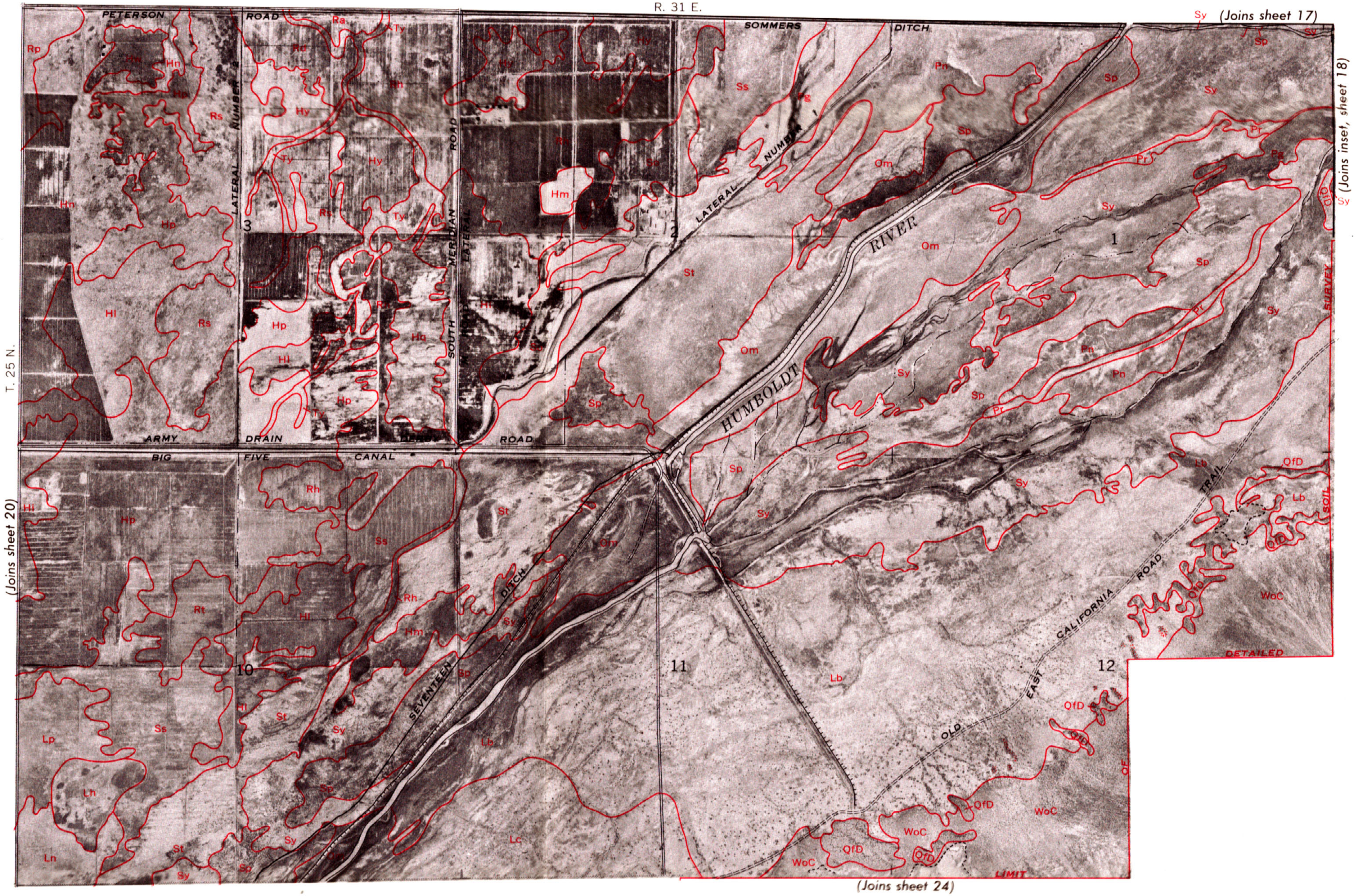

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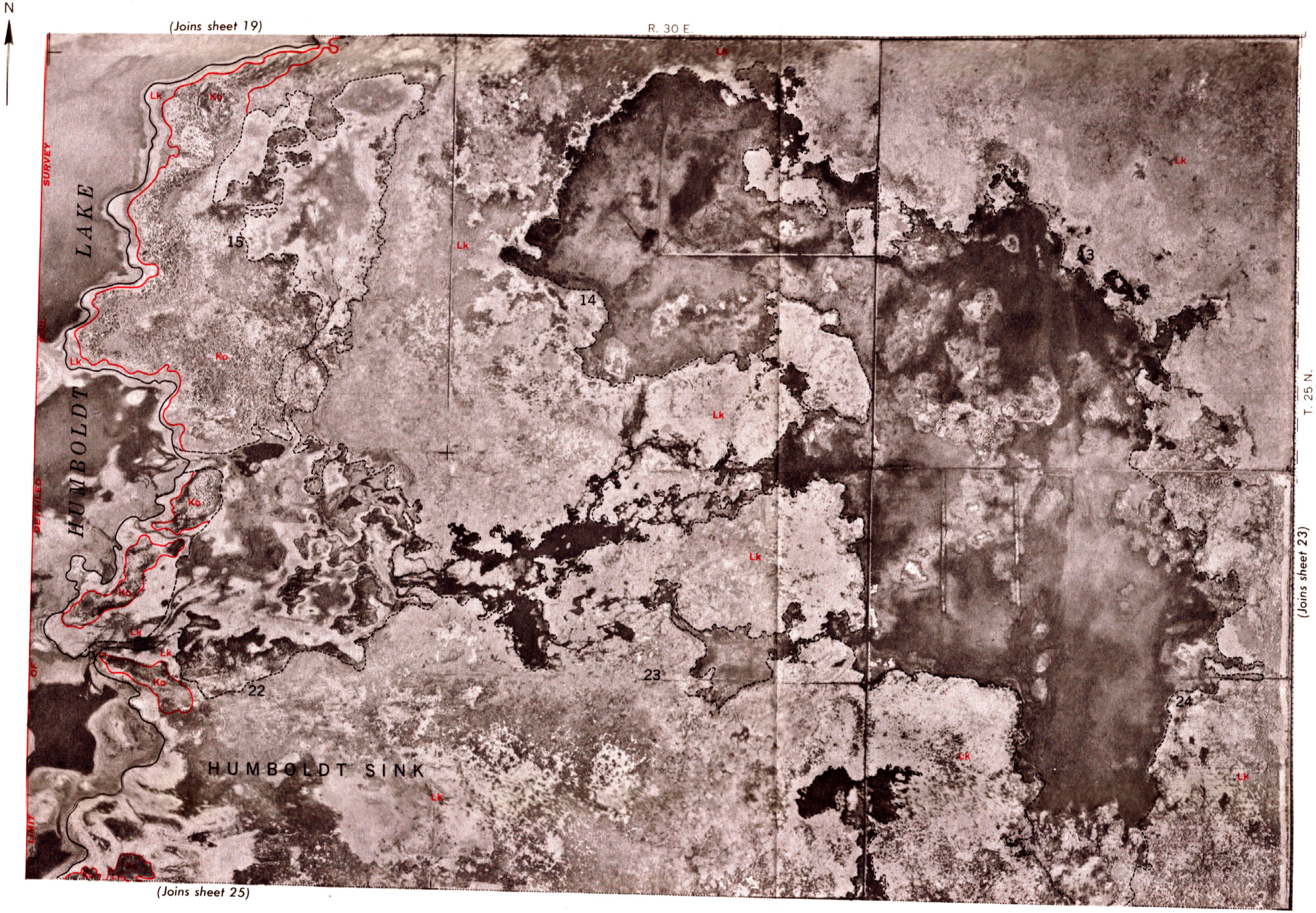

0 ½ Mile Scale 1:15840 0 3000 Feet

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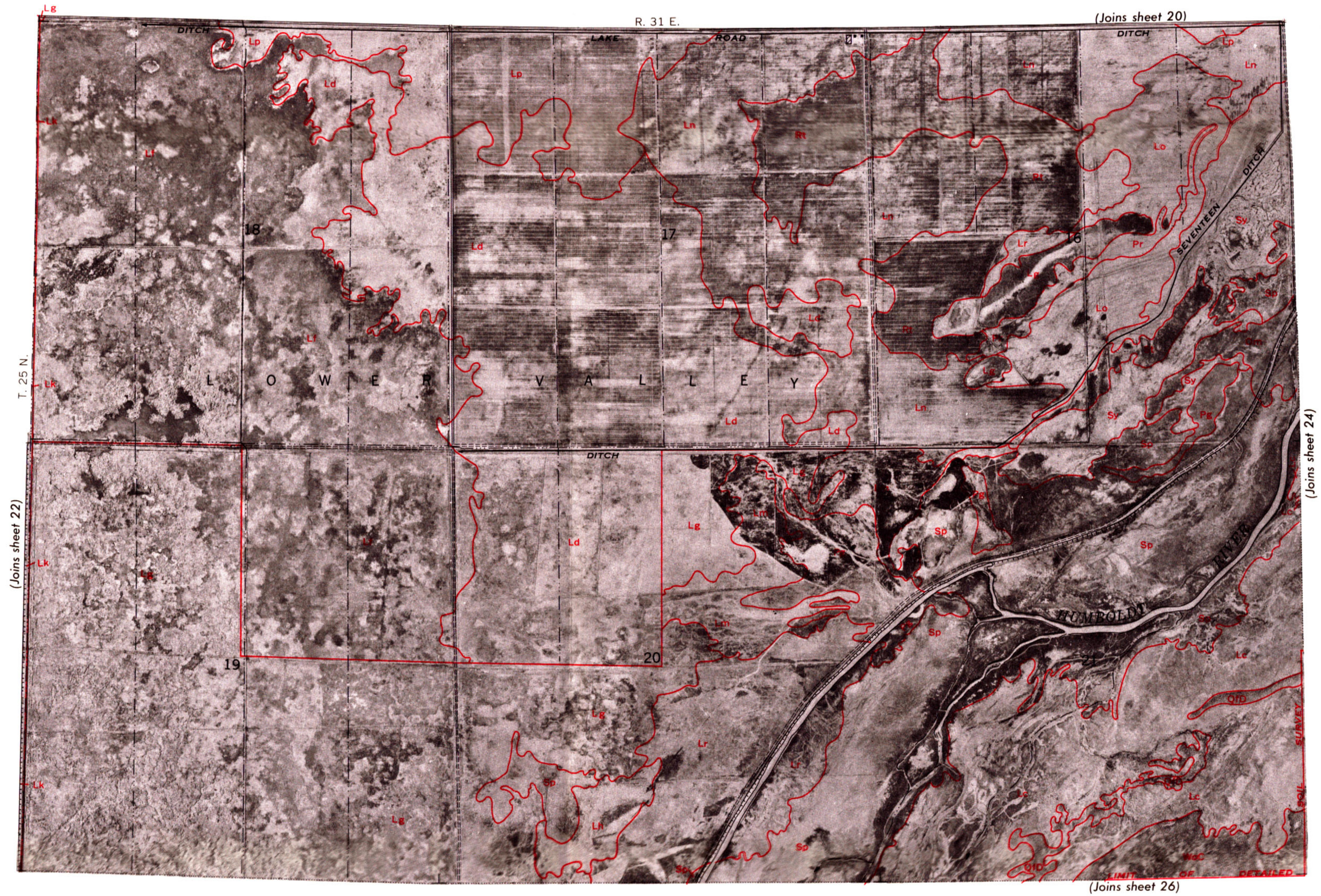

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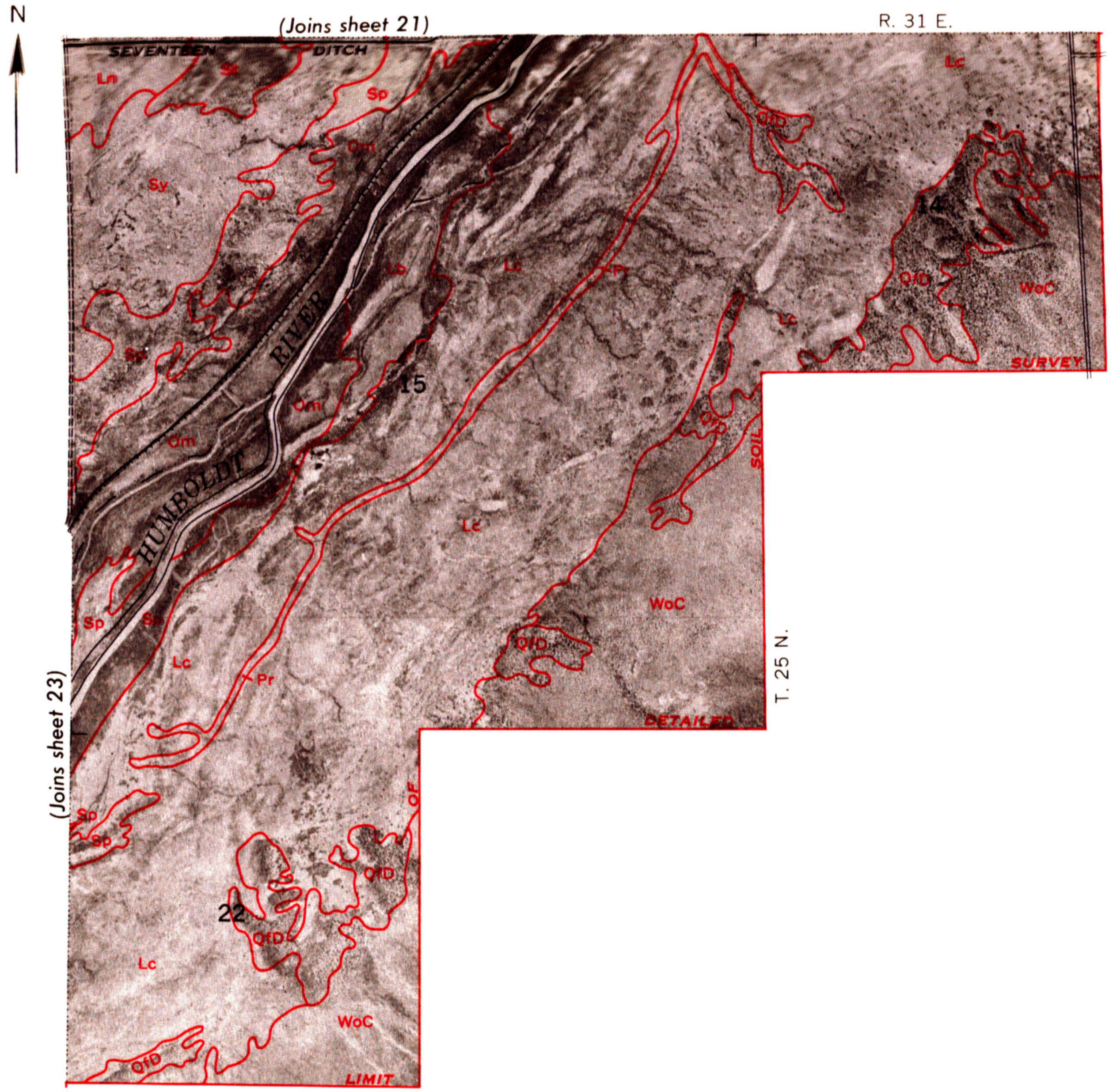

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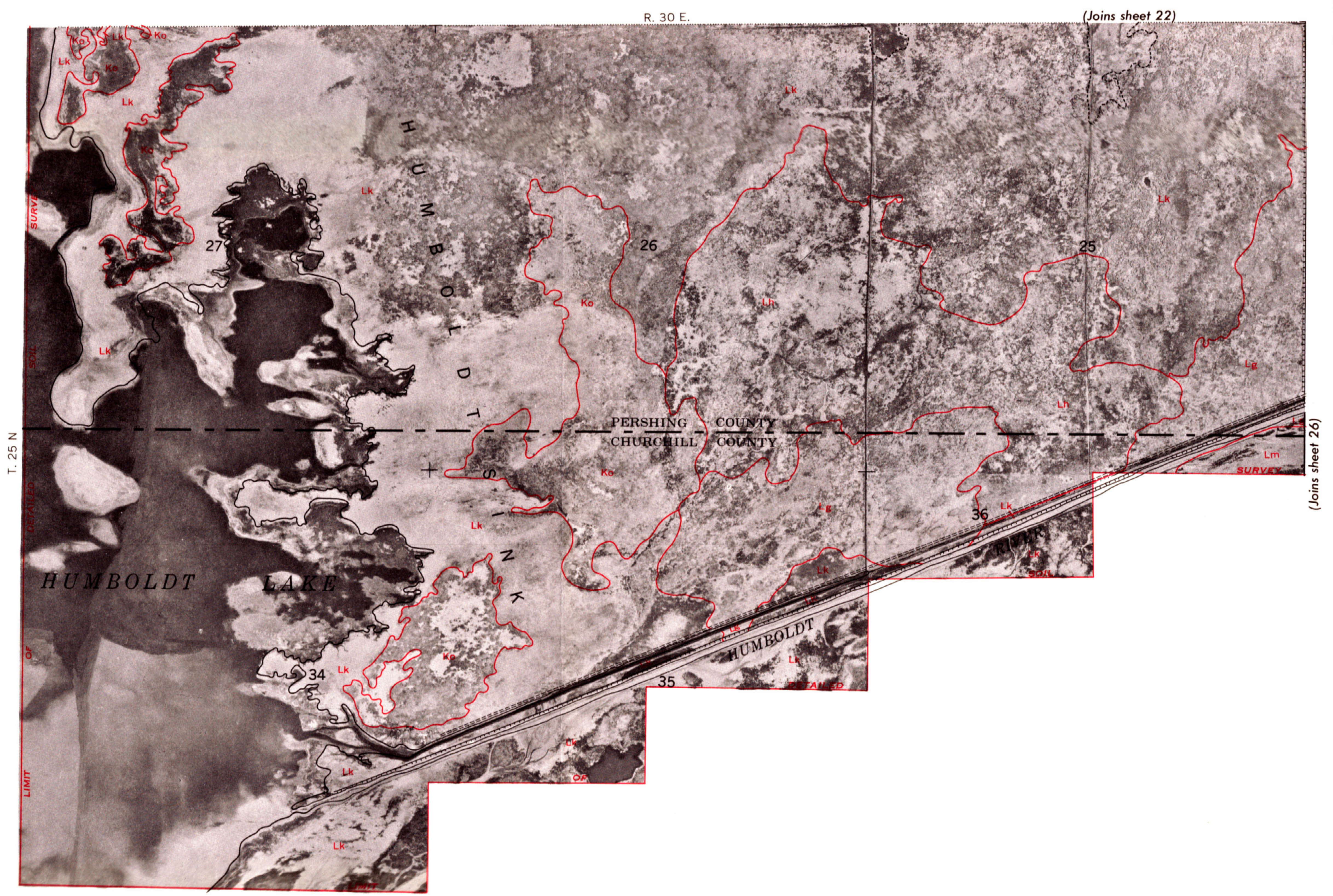

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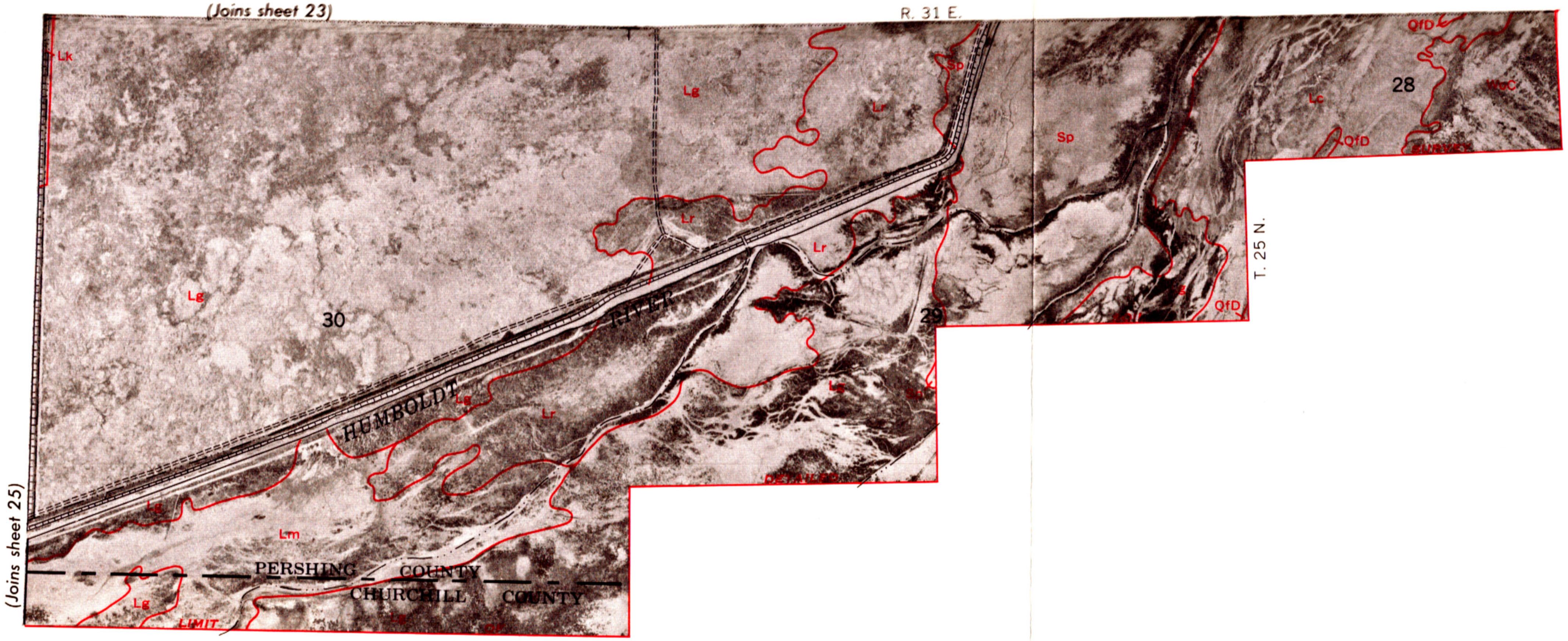
LOVELOCK AREA, NEVADA — SHEET NUMBER 26

N



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